S.14.

PROCEEDINGS

OF THE

BELFAST

Natural History and Philosophical Society,

FOR THE

SESSION 1881–82.

BELFAST:
PRINTED BY ALEXANDER MAYNE, CORPORATION STREET.
(PRINTER TO THE QUEEN'S COLLEGE.)

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Belfast Natural History and Philosophical Society.

ESTABLISHED 1821.

SHAREHOLDERS.

1 Share in the Society costs £7.
2 Shares ,, ,, cost £14.
3 Shares ,, ,, cost £21.

The proprietor of 1 Share pays 10s. per annum; the proprietor of 2 Shares pays 5s. per annum; the proprietor of three or more Shares stands exempt from further payment.

Shareholders only are eligible for election on the Council of Management.

MEMBERS.

There are two classes, Ordinary Members, who are expected to read Papers, and Visiting Members, who, by joining under the latter title, are understood to intimate that they do not wish to read Papers. The Session for Lectures extends from November in one year till May in the succeeding one. Members, Ordinary or Visiting, pay £1 1s. per annum, due first November in each year.

PRIVILEGES.

Each Shareholder and Member has the right of personal attendance at all meetings of the Society, and of admitting a friend thereto; also of access to the Museum for himself and family, with the privilege of granting admission orders for inspecting the collections to any friends not residing in Belfast.

Any further information can be obtained by application to the Secretary. It is requested that all accounts due by the Society be sent to the Treasurer.

The Museum, College Square North, is open daily from 12 till 4 o'clock. Admission for strangers, 6d. each. The Curator is in constant attendance, and will take charge of any Donation kindly left for the Museum or Library.

BELFAST

Natural History and Philosophical Society.

ANNUAL REPORT, 1882.

THE Council for the past year, appointed by the Shareholders at their annual Meeting, on the 7th June, 1881, desires to lay before them its Report on their property, and the other interests of the Society.

The Museum collections are in very good condition, and much has been done during the past year by your curators, with the assistance of some members of the Society, in the way of re-arranging and labelling the specimens; much progress has also been made in the preparation of a catalogue of the collections, the first part of which has been published this year.

The employment of two curators, although of undoubted advantage, has entailed considerable additional expense on the Society, which your Council regrets to say, has not yet been met by any adequate increase of shareholders and subscribers.

A number of specimens have been added to your collections during the past year, a list of which will be given at the end of this report.

With regard to your library, the librarian has had the books re-arranged and a full catalogue made of them, which he is in a position to publish whenever desired. We continue to receive, in exchange for our transactions, reports of proceedings from the various leading philosophical and scientific societies in Europe, Asia, Australia, and America; a list of these publications is appended to this report.

On Easter Monday the Museum was thrown open to the public, as has been customary for many years, at a charge of two pence for adults, and a penny for children, when about six thousand persons visited it during the day. These evinced much interest in the various objects displayed for their examination, and their conduct was most exemplary.

There have been seven ordinary meetings of the Society held during the past session:—the first meeting, on the 1st November, 1881, Mr. Robert Young, C.E., in the chair, when an introductory address on the past history and present position of the Society was read by your President, Mr. R. Lloyd Patterson. The second meeting, on the 6th December, 1881, the President in the chair, when Professor Everett read a paper entitled, "Reminiscences of the Paris Electrical Exhibition and Congress." The third meeting, on the 10th January, 1882, the President in the chair, a paper was read by Mr. Joseph John Murphy on "The Rainy or Post-Glacial Period." The fourth meeting, on the 7th February, 1882, the President in the chair, when Professor Letts read a paper on "Diamonds." The fifth meeting, on the 7th March, 1882, the President in the chair, a paper was read by Professor Cunningham on "Corals and Coral Islands." The sixth meeting, on the 4th April, 1882, the President in the chair, a paper was read by Mr. Robert Young, C.E., entitled, "Notes on Bun-a-Mairge Abbey and its surroundings." Mr. Isaac J. Murphy also read a short communication on "A Recent Mechanical Invention by Monsieur Peaucellier." The seventh meeting, on the 25th April, 1882, the President in the chair, a paper was read by the Rev. Robert Workman, of Newtownbreda, entitled, "Forts, Houses, and Churches of Ancient Ireland."

As well as these ordinary meetings, a special meeting was held on the 17th March, 1882, in St. George's Hall, the President, Mr. R. Lloyd Patterson, in the chair, when a lecture was delivered by Mr. Alfred Russell Wallace, F.L.S., F.R.G.S., on "Island Life."

In August last Mr. A. O'D. Taylor, who had acted as Hon. Assistant, Joint or Sole Secretary since the year 1849, a period

of thirty-two years, resigned his office, and shortly afterwards went abroad.

To fill the vacancy thus created, your Council elected Dr. Charles Workman to the Honorary Secretaryship of the Society, and your Council congratulate the Society in having been able to secure the services of a gentleman so eminently qualified in every way as Dr. Workman has proved himself, to discharge the duties pertaining to the office.

It will be seen from the Treasurer's Report that there have been some items of special expenditure during the past year, but against these there have been some unusual sources of income, so that the accounts show a small balance in our favour.

Your Council is sorry to have to report that your Treasurer, Mr. John Anderson, after ably and energetically serving the Society in that office since 1871, a period of eleven years, has signified his desire to retire from the Treasurership.

Your Council now retires from office, and this meeting will be asked to elect fifteen members to form a new Council in its stead. Most of the members of the old Council, being eligible, offer themselves for re election.

R. LLOYD PATTERSON,

14th June, 1882. PRESIDENT.

APPENDICES.

I.

Report from the Sub-Committee appointed to Superintend the Curators.

The Natural History Collection.

During the past year Mr. Stewart being principally engaged in arranging and cataloguing the Antiquities, &c., little opportunity occurred of having work done to the Natural History Collections.

The Mammalia in the large case under the gallery of the upper room, were, however, removed from their places, and cleaned, the stands upon which the specimens are mounted were painted, as was also the entire case ; several shelves were altered, and the specimens were more fully displayed.

The horns and antlers in the opposite case were removed: many of them were mounted and displayed on the cases and walls of the Lecture-room, the case being afterwards painted for the reception of foreign weapons, &c. The case from which the foreign weapons were removed is now being prepared for the reception of your large collection of exotic shells, at present scattered in different cases and cabinets throughout the building. This collection with others is much in need of arrangement, and we look forward with confidence to Mr. Stewart's scientific knowledge soon shewing itself by a better display of the objects under our care and the rendering them more valuable for educational purposes.

Ethnology.

The foreign dresses, weapons, &c., have been numbered, and all particulars entered in the register ; the cases have been painted, and the specimens have been cleaned and re-arranged in the cases under the gallery.

Signed, Joseph Wright.
William Swanston.

Antiquities.

The entire collection has been cleaned, numbered, and registered, *i. e.*, entered in a book with all the information that can be gained concerning them.

The stone implements, including those in the Benn collection, have been catalogued, and the catalogue printed and issued.

Owing to changes which were made in the arrangement of the catalogue, part of this work had to be gone over twice.

Signed, W. H. Patterson.

The Library.

Regarding the Library, I have to report that Mr. Stewart has checked the old catalogue and made all entries of new books up to date, so that a new catalogue may be printed at any time you give me authority to do so. The books have also been arranged in the cases in the new library as far as room was available.

Signed, T. Workman.

II.

DONATIONS TO MUSEUM, SESSION 1881–82.

From A. O'D. Taylor, Esq.

Red Backed Shrike—the first Irish specimen on record.

From W. H. Patterson, Esq., M.R.I.A.

Convolvulus Hawk Moth.

From Samuel Seal, Esq., F.G.S., *per* W. H. Patterson, Esq., M.R.I.A.

Nine Specimens of Fossils, from the coal measures.

From Charles Dundee, Esq., *per* Belfast Naturalists Field Club.

Specimen of Basalt used for square sets, from Ballintoy, Co. Antrim, with chemical analysis.

From A. W. Blackwell, Esq., *per* Belfast Naturalists Field Club.

Stone Grain-rubber, found in pre-historic dwelling at White-park Bay, Ballintoy, 1881.

From Mr. William Millar.

Skull, found at the pre-historic burial place at the "Madman's Window," Glenarm, 1880.

From Seaton F. Milligan, Esq.

Cinerary Urn, broken, found near Omagh.

From John Ward, Esq., F.G.S., *per* Robert Young, Esq., C.E.

Block of Sandstone, from Scrabo Quarries, displaying supposed impressed footprints of an animal.

From Walter Jamieson, Esq.

A piece of Fossilized Wood embedded in bauxite, found near Glenarm.

From The Linen Hall Library.

"Hortus Siccus Britannicus," of James Dickson, F.L.S., consisting of 14 fasciculi of dried plants.

From The British Museum.

A Selection of the British Museum Duplicates, consisting of Insects, Birds, Shells, and Echinodermata, amounting in all to nearly 3,000 specimens.

III.

BOOKS RECEIVED, 1881–82,

From the Institutions whose names are stated below.

Batavia—Naturkundig Ligdschuft Voor Nederlandish, Indie. Deel 40, Achste serie deel 1 1881. *The Society.*

Belfast.—Observations on Aulastoma Heluo. By Robert Templeton, Esq., M.D. *The Author.*

BERLIN.—Gesellschaft für Erdkunde.
Verhandlungen. Vol. 8, parts 4, 5, 6, 7, and 8.
Do. Vol. 9, parts 1, 2, 3, and 4, 1882.
The Society.

BOLOGNA.—Rendiconto dell Accademia delle Scienze, 1880–81.
The Society.

BOSTON.—Science Observer. Vol. 3, parts 33, 34, 35, 36.
The Editor.

BREMEN.—Naturwissenchaftlichen Verein.
Abhandlungen. Bd. 7, heft 1, 2, and 3, 1882.
Do Beilage, No. 8, 1880.
The Society.

BRIGHTON.—Annual Report of Brighton and Sussex Natural History Society, 1881. *The Society.*

BRUSSELS.—Sociétié Entomologique de Belgique.
(Comptes Rendus). Series 3, Nos. 4, 5, 6, 7, 8, 9, 10, 14, 15, and 16, 1881. *The Society.*
Société Royal Malacologique de Belgique.
Tome 10 and 11, 1881-82. *The Society.*
Société Royal de Botanique de Belgique.
Bulletin. Vol. 20, 1881. *The Society.*

CALCUTTA.—Geological Survey of India.
Memoirs. Vol. 6, parts 2 and 3.
Palaeontologica Indica; Fossil Flora of the Gondwanas. Vol. 3, parts 2 and 3.
Index to do. Vols. 1 and 2.
Fossil Flora of the Gondwanas. Supplemental Vol. 3, part 1.
Records. Vol. 13, parts 3 and 4; and Vol. 14, parts 1, 2, 3, 4.
Memoirs. Vol. 18, parts 1, 2, and 3.
Do Palaeontologica. Series 13, vol. 1, part 3.
Do The Fossil Echinoidea. Series 14, 1882.
Do of the Geology of India. Part 3.
The Survey.

CARDIFF.—Naturalists' Society Report and Transactions.
Vol. 12, for 1881, *The Society.*

CASSEL.—Verein für Naturkunde.
Bericht, 1881. *The Society.*

CHERBURG.—Société des Sciences Naturelles et Mathematiques.
Memoirs, 3rd Series, part 2, book 22.
Library Catalogue. *The Society.*

CINCINNATI.—Ohio Mechanics Institute.
Scientific Proceedings. Vol. 1, 1882. *The Institute.*

DANZIG.—Naturforschenden Gesellschaft.
Schriften, New Series, book 15, 1st and 2nd part, 1881.
The Society.

DUBLIN.—Royal Dublin Society.
Scientific Transactions. Vol. 1, series 2, April and October, 1880-81.
Scientific Proceedings, vol. 2, part 7, 1880; vol. 3, pts. 1 to 4, 1881. *The Society.*

EDINBURGH.—Botanical Society.
Transactions. Vol. 14, part 2, 1882. *The Society.*

ESSEX.—Epping Forest and County of Essex Field Club.
Transactions. Vol. 2, part 4, 1881. *The Club.*

FLORENCE.—Atti della Societa Toscana di Scienze Naturali.
Processi Verbali. Vol. 3, for 1881-82. *The Society.*

GENOA.—Societa di Letture e Conversazioni Scientifiche.
Giornale anno 6. Fasc. 1—4, 1882. *The Society.*

GIESEN.—Oberhessichen Gesellschaft.
Für Natur und Heilkunde. Vol. 20 1881. *The Society.*

GLASGOW.—Natural History Society.
Proceedings. Vol. 4, part 2, 1879–80. *The Society.*
Philosophical Society.
Proceedings. Vol. 13, No. 1, 1880-81. *The Society.*

GLASGOW.—The Gas Question, 1882. James Adams, M.D.
The Author.

GORLITZ.—Naturforschenden Gesellschaft.
Abhandlungen. Vols. 17, 1881. *The Society.*

HAMBURG-ALTONA.—Naturforschenden Gesellschaft.
Verhandlungen, 1880. *The Society.*

HARVARD.—Museum of Comparative Zoology.
Annual Report, 1880-81.
Bulletin. Vol 8.
Bulletin. Vol 6, No. 12, October, 1881 ; Vol. 9, Nos. 1, 5, June, December, 1881. *The Society.*

HERTFORD.—Hertfordshire Natural History Society and Field Club.
Transactions. Vol. 1, parts 2, 3, 5, and 7, 1880-81.
The Club.

KLAUSENBURG.—Magyar Novenytanclopok.
Parts 4 and 5, 1880-81. *The Society.*

LAUSANNE.—Société Vaudoise.
Bulletin. Vol. 17, Nos. 85 and 86, 1881.
The Society.

LIVERPOOL.—Literary and Philosophical Society.
Proceedings. Vols. 33 and 34 for the Sessions 1878–79, 1879–80. *The Society.*
Split and Other Boulders. by Charles Rickets, M.D., F.G.S., 1881. *The Author.*

LONDON.—Zoological Society.
Proceedings. Parts 1, 2, 3, and 4, 1881.
The Society.
Royal Microscopical Society. Series 2, vol. 1, parts 3, 4, 5, and 6, 1881. Vol. 2, parts 1 and 2.
The Society.
Scientific Roll, "Climate." Parts 1 to 4, 5, 6, 1882.
The Editor.

LONDON.—Royal Astronomical Society.
Memoirs. Vol. 46, 1880, 1881. *The Society.*

MANCHESTER Geological Society.
Vol. 16, parts 10, 1880-81, parts 11, 12, and 13, 1881-82.
The Society.

NEW YORK.—American Geographical Society.
Bulletin. No. 4, 1880. No. 2, 3, and 4, 1881.
Bulletin. No. 6 of vol. 11, 1879. No. 5 of vol. 12. 1880,
Journal. Vols. 11 and 12, 1879-80. *The Society.*

PISA.—Atti della Societa Toscana di Scienze Naturali.
Adunanzia del di. 8 Maggio, 1881. *The Society.*

RIO JANEIRO.—Archives of the National Museum.
Vol. 3, 1878. *The Museum.*

ROME.—Atti della R. Accademia dei Lincei.
Volume 6, Series 1, 2, 3, 4, 5, 6, 7, 8, and 10, 1882.
The Society.

SONDERHAUSEN.—Irmischia. No. 1, 1881 ; No. 65, 1, 2, 3, and 4.
The Editor.

STOCKHOLM.—L'Academie Royale Suedoise des Sciences.
Memoirs. No. 4 to 14.
Atlas of Plates of Seaweed.
Das| Gehororgan der Wirbelthere. Part 1. Von Gustaf Retzius.
Bihang Fjeide Bandet. Part 1877.
Bihang Femte Bandet. Part 1878.
Oversight. No. 34, 1877-78 ; No. 35, 1878-79 ; No. 36, 1879-80 ; No. 37, 1880-81.
Lefnadsteckningar. Book 2, part 1, 1878.
The Society.

VIENNA.—K. K. Geologische Reichsanstalt.
Verhandlungen. Nos. 1 to 18, 1881.
Catalog der Austellungs Gegenstande bei der Weiner Weltausstellung, 1873. *The Society.*

WARWICK.—Warwickshire Field Club,
Proceedings, 1881. *The Club.*

WASHINGTON, U.S.A.—Department of Agriculture.
Annual Report, 1878-79.
Memorial of Joseph Henry. *The Department.*
Smithsonian Institute.
Report, 1879.
Contributions to Knowledge, vol. 23.
Miscellaneous Collection, vols. 18 to 21. *The Society.*
Geological Society.
1st Annual Report, 1880. *The Society.*

YOKOHAMA.—Mittheilungen der Deutschen Gesellschaft für Natur und Volkerkunde Ostasiens, 26stes Heft, 1882. *The Society.*

PRESIDENTIAL ADDRESS:

AN HISTORICAL SKETCH OF THE SOCIETY,

DELIVERED BY

R. LLOYD PATTERSON, Esq.,

On Tuesday Evening, 1st November, 1881.

On assuming, for the first time at a public meeting, the Presidential Chair of the Belfast Natural History and Philosophical Society, I feel it a primary duty sincerely to thank my fellow-members for having conferred on me the honour of electing me to that position. It were the merest affectation to profess myself otherwise than deeply sensible of the high compliment conveyed in such an appointment. To be successor to those gentlemen who have occupied the chair since the foundation of the society sixty years ago, many of them men of the highest eminence in different branches of science, is a position of which any man, and particularly any business man, may well be proud. Yet I am not so vain as to arrogate the compliment, more than in a very minor degree, to myself; for I feel it is mainly due to the kindly feeling still animating many members of the society towards my father's memory, and to a desire on their part to honour it through me. But it is no affectation to say, as I really feel, how utterly unfit I am for the position. The cares and pressure of business and other engagements, coupled, I suppose, with a want of proper application, have left me in the position of not having cultivated any branch of science. I am therefore quite unable to present you with any-

thing like what an inaugural address should be ; and I shall not attempt to imitate the brilliant flights of some of my predecessors in their opening addresses. Fortunately for me, chance comes to my assistance, and, by a coincidence unknown to my fellow members when they elected me, and only lately and quite accidentally noticed by myself, it so happens that this very evening is, to a day, the fiftieth anniversary of the public opening of this Museum, that ceremony having taken place on Tuesday, the 1st of November, 1831. It has therefore occurred to me that an historical sketch of the society and of this building, to myself associated with life-long, interesting, and pleasant recollections, might not be uninteresting to some of our present members who know but little of our earlier history ; and I hope that such a sketch may be allowed to pass on this, the occasion of our jubilee, as a substitute for the usual opening address.

This society, then, was founded on 5th June, 1821, when, at a meeting held at the house of Dr. James L. Drummond, he and seven other gentlemen resolved to form themselves into the "Belfast Natural History Society." These seven others, named in the order in which they appear in the society's records, are the following:—William M'Clure, jun., George C. Hyndman, James Grimshaw, jun., Francis Archer, James MacAdam, jun., Robert Patterson, jun., and Robert Simms, jun. The meetings of the society, for more than a year after its foundation, were held at the house of its first president, Dr. Drummond. Recourse was then had to one of the rooms in the adjacent building of the Royal Academical Institution ; and another year saw the necessity of still larger accommodation, so that the winter of 1823 finds the society meeting "at their rooms in the Commercial Buildings," where also a collection of objects of natural history, the nucleus of the present Museum, began to be formed. To some the names of a few of the earlier members of the society may be interesting. There joined it in the year of its foundation, 1821, William Tennent, the banker ; and in the same year James Emerson, afterwards Sir James Emerson Tennent, a life-long friend and supporter of the so-

ciety, and a most liberal contributor to its collections. Professor Stevelly joined in 1824; William T. Harvey and Surgeon M'Gee in 1825; Robert James Tennent and S. K. Mulholland in 1826; James Bryce and John Thomson in 1827; Dr. MacCormac and Robert S. MacAdam in 1828. The Marquises of Donegall and Downshire became members in 1830; Mr. Grattan in 1831; Dr. Andrews in 1835; and Mr. Gordon Thomson, of whom I may speak as I did of Sir James Emerson Tennent, in 1837. Mr. William Thompson, certainly one of the most distinguished men we ever numbered among our ranks, joined the society in 1825. He was then in his twenty-first year; and it is not long till we find him at his favourite subject, as in 1827 he read a paper on "The Birds of the Copeland Islands."

The society made rapid progress in popularity and membership. Early in 1829, the first mention of any project for a building appears in its records, although, from the way the subject is then mentioned, it is evident it had been under consideration previously. Thus I find on 17th January of that year a resolution was passed declining, with thanks, an offer from "the managers of the Savings Bank respecting the intended building," and further resolved:—"That Dr. Drummond, Mr. Mitchell, Mr. Getty, Mr. Hyndman, and Mr. Patterson be appointed a committee to consider a prospectus to be prepared for opening a subscription towards a building for the purposes of the society." The matter appears again in the minutes of a meeting on 4th February, when mention is made of some negotiations with Mr. Adam M'Clean about a piece of ground in Queen Street. The question crops up again at the next meeting, on 11th February, 1829, when four out of the five gentlemen just named "were appointed to have the prospectus finally arranged," and on 21st February Mr. Getty read a prospectus, which was approved of and ordered to be printed." This prospectus, the subject of so much anxious consideration, was thereupon launched. It bears date 25th February 1829, and to it are appended the names of James L. Drummond, M.D. as president, and George C. Hyndman, as secretary, Dr. Drum-

mond having been re-elected president in 1827, after that office had been held for five years by the Rev. Dr. Hincks. The prospectus is evidently a very carefully prepared composition. Commencing with an account of the origin, aims, and objects of the society, it states that, from the original eight members in 1821, its numbers had then, in 1829, increased to sixty-one; and an appeal is made to the public spirit of the townspeople, to aid in the erection of the projected building, arguing that the benefits conferred by such institutions are two-sided, *i.e.*, to the advantage both of the public and the society. The *Northern Whig* newspaper of the time, then, as ever since, in the forefront of enlightenment and progress, noticed this effort on the part of the young society very favourably. "We have received," it said, "much pleasure from a circular lately issued by the Natural History Society of this town;" and, after giving some extracts from the circular, the *Whig* continued: "After having thus sketched the progress and objects of the society, the circular proceeds in the following truly philosophical manner." Whereupon follow further extracts, the *Whig* concluding as follows:—"Collections of this nature are now (*i.e.* in 1829) to be found in most of the Continental cities, and in the principal towns of the sister kingdoms, and when we consider that Belfast is inferior to none in its liberality and public spirit, we are convinced that no difficulty will be experienced in collecting the funds necessary for so desirable an object." On 13th May "a conversation took place on the subject of the intended building for a Museum," and it was unanimously resolved that five gentlemen named be appointed a committee, with instructions to conclude a bargain for a piece of ground in College Square North for that purpose. Nothing further on the subject appears till 21st October, when we find a record approving of the action of the committee in calling a general meeting of the subscribers for the following day; and at the meeting so held, William Tennent, Esq. was elected treasurer, and a committee of fifteen subscribers was appointed "to determine on a plan, to receive estimates, and take such other measures as may be necessary for the erection of the building."

Matters progressed so that in January 1830, advertisements for estimates for the proposed building appeared in the local papers, Messrs. Duff and Jackson being the architects. The latter gentleman, Mr. Thomas Jackson, is still among us. The foundation stone of the building was laid by the Marquis of Donegall on 4th May, 1830, the *Belfast Commercial Chronicle* of the following day giving an interesting account of the ceremony. After the introductory paragraphs this report proceeds to state that "the foundation stone was then laid by his Lordship with the usual formalities; the silver trowel employed being the same which his Lordship had used in laying the foundation stone of the Academical Institution, and of a number of our other public buildings. Dr. Drummond, as president of the Natural History Society, then stated that the bottle which was deposited in the first stone contained, among many other things enumerated, 'some verses from the twelfth chapter of Job, in fifteen different lauguages.' William Tennent, Esq., then addressed his Lordship, and expressed, on the part of the Natural History Society, their thanks for his Lordship's attendance on that occasion, and for his uniform attention to the welfare of our various public institutions. The loud acclamations of the concourse of spectators who had assembled to witness the ceremony, evinced the interest they felt in the commencement of a building which, we have no doubt, will be highly creditable to the taste and liberality of our town." The public opening of the Museum took place on Tuesday, 1st November, 1831, and, from the length at which the proceedings are reported in the local papers of the period, it is evident that the event was regarded as one of no small interest and importance. Mr. Edmund Getty, one of the vice-presidents, read the report, which on an occasion of the kind was more than an annual report, and gave a brief history of the society from its foundation, ten years previously, by the eight gentlemen whom I have already named, up to the period under notice. The number of ordinary members at the time of the opening of the Museum had increased to 91, and in addition there were a number of corresponding, visiting, and honorary members, residing in

other parts of the kingdom and in foreign countries. Up to the day of opening, out of a total of about £2,000 required at first, a sum of rather over £1,400 had been raised—a large amount considering the number and means of the inhabitants of the town at the time, and one which speaks well for the liberality and public spirit of our ancestors. The report of the council was followed by an address from the president, Dr. Drummond, who, after expressing his pleasure at the state and prospects of the society, alluded to the acknowledged fact that the pleasure of seeing animals in their natural state is greater than that excited by seeing the same objects preserved in a museum, but rebutted the arguments of those who decry museums on that account, and who say that no one can be a naturalist except those who become so by their own observations, pointing out the advantages that museums afford in bringing before us at one view the animals of the most distant quarters of the world. Referring to the importance of books to the naturalist, he remarked that, although observation is the only way in which new facts can be acquired and existing errors corrected, yet it is by books alone that those facts can be communicated to others. To men of business, whose occupations debar them from opportunities of personal observation, books supply the information they could not otherwise obtain. Next, arguing that every branch of science is useful to every other branch, he urged the propriety of adding a knowledge of natural philosophy, chemistry, &c., to that of natural history, and concluded by expressing a hope, with which, after the lapse of fifty years, I entirely sympathise, that an occasional exhibition of the fine arts might be held in the large upper room of the Museum. A Dublin journal of the period concluded a flattering notice of the society and the Museum as follows :—" The Belfast Museum is the first ever erected in Ireland by voluntary subscription, and it has our warmest wishes for its success. We have marked the progress of the society to which it owes its origin with deep admiration, and we have sincere pleasure in placing it before the public as an example worthy of imitation, and deserving of national applause."

At a public meeting of the society, held on 19th September, 1833, a statement of the total receipts and expenditure to date was submitted. From that it appeared that the total cost of the building and of furnishing the parts then in use amounted to £2,321 9s. 8d., and the receipts were £1,594 8s. 6d., leaving a balance due of £727 1s. 2d. A new financial scheme was proposed with a view of liquidating this debt, and this scheme was so successful that by October it was announced that, through the continued exertions of some members of the society, the Museum was then absolutely free from debt.

Up to, and for some time after the year 1836 the large upper room of the building continued unfurnished, but not entirely unused, as during the period from 1836 to 1843, I find mention of several exhibitions of paintings being held in it. The following paragraph is from the annual report presented in May, 1838 :— "'The Belfast Association of Artists,' having applied this session again for permission to hold another exhibition of paintings in the Museum, the council agreed to their request, and a large collection of paintings and statuary was accordingly exhibited for six weeks. . . . The success of these exhibitions has led to a proposal for erecting in Belfast a building devoted entirely to the fine arts." I observe that in 1842 the "Northern Art Union" were having an exhibition of paintings in the Museum, and a "fashionable promenade," with a regimental band in attendance, was advertised to take place on 1st and 3rd December. In August, 1843, another exhibition of paintings, this time got up by the "Belfast Fine Arts Society," was opened in the Museum. Here within seven years there appears to have been three bodies or associations holding art exhibitions in our building. Meantime the meetings of the society had become so popular and largely attended that the accommodation in the ordinary lecture-room was inadequate, and more space was wanted for the proper display of the constantly increasing collections. It was therefore proposed (in 1838) "to erect in the rear of the Belfast Museum a spacious lecture-room, with a laboratory and an apparatus-room attached." The estimated cost of this projected building was £800, towards

which, by February, 1839, £300 had been subscribed. Subscriptions seem, however, to have come in but slowly, for in February, 1840, some reductions of expense in the erection of the projected new building were discussed. The following month sees the scheme again before the public, a circular respecting it, and bearing the names of three prominent members of the society, having been issued. The project seemed after this to lie in abeyance for several years, till March, 1844, when it was revived, and another circular on the subject appears in February, 1845; but at the annual meeting held on 13th May, 1846, the report stated that the views of the council had been modified by circumstances, and the council recommended instead that the large upper room be fitted up for the reception of cases and specimens. The report submitted to the annual meeting in 1847 stated that, owing to the "distressing calamities" under which the country was suffering, no progress had been made; and it was not till 1850 (although frequent allusions to the subject appear in the interim) that the fitting of the upper room was definitely decided on, and ordered to be completed before the next session opened. This was done; and accordingly in that year, 1850, the upper room was fitted up in the manner in which, with some minor changes, you still see it.

The idea of inviting the British Association for the Advancement of Science to hold its annual meeting in Belfast, which it did in 1852, was first publicly mooted at a conversazione held in the Museum on 16th January, 1849, and the invitation was given at the meeting of the association in Birmingham that year.

Nothing of special moment occurred in the society till 1852, when, at the close of a meeting held on 18th February, it was announced that "Mr. Patterson had just received a letter from London," communicating the melancholy intelligence of the death there of Wm. Thompson, Esq., the president of the society, on the morning of the previous day, the 17th. The death of this eminent naturalist and accomplished gentleman in the prime of life, his 47th year, inflicted an almost irreparable loss on the society, of which he was such a distinguished orna-

ment. Many of his fellow-members were equally earnest ; indeed it was hardly possible to come much into contact with him without sharing his enthusiasm ; but of his colleagues on the council at the time there was not one who had not either business or professional engagements that had a first claim on their time and thoughts ; Mr. Thompson himself being the only member of the council possessing ample private means and complete leisure. Both he placed freely at the disposal of his fellow-members, and he formed a most useful connecting link between the then still comparatively young provincial society and the older and larger metropolitan societies, of England and Scotland, as well as of this country. Our society lost no time in taking steps to mark their sense of the loss they had sustained in Mr. Thompson's removal, and of their determination to perpetuate his memory. The erection of the "Thompson room," to contain the collections bequeathed by him to the Museum, was almost at once determined on and proceeded with, the appeal of the council to the public for funds being so promptly and liberally responded to that the room was completed by the autumn of that same year—1852—when the meeting of the British Association was an event of considerable importance to us, giving a stimulus to scientific pursuits, and imparting a prestige to the society that continued for long after.

The gentlemen who have held the office of president after Mr. Thompson' decease were Mr. Patterson, from 1852 to 54, and on three subsequent occasions ; Dr. Andrews, from 1854 to 56 ; Dr. Stevelly, from 1856 to 58; Mr. Hyndman, from 1858 to 60; Mr. James MacAdam, from 1860 to 61, but he died a few days after his re-election in the latter year. Dr., now Sir C., Wyville Thomson was our president from 1862 to 64, and again later ; Professor James Thomson, from 1864 to 66 ; Mr. Joseph John Murphy, from 1866 to 68, and again from 1871 to 75. Mr. Murphy may now be regarded as one of our older, and he certainly always has been one of our most learned, useful, and energetic members. We have also had Dr. Hodges ; and since then Mr. Robert Young, than whom we have had no superior in any time ; Professor Purser ; and, finally, the individual who now has the

honour of addressing you. I hope I have not overlooked mentioning anyone ; and, assuming my enumeration is correct, it makes fifteen presidents in the sixty years of the society's existence.

I omitted mentioning in its proper place that very many years ago, I think it was in 1840, the society changed its name from its original appellation of the Belfast Natural History Society to the more comprehensive title which it still bears, and at the same time enlarged the scope of its operations in the direction indicated by this change. During the past five or six-and-twenty years the society has experienced some vicissitudes of fortune. About the time of the erection of the Thompson room, the funds for which were easily obtained, a debt of about £300 due by the society began to be increased by additional expenses being incurred without any concurrent increase of income, so that by June, 1855, the debts of the society had increased to £500 of borrowed money and £168 due for accounts, a total indebtedness of £668. The council then became thoroughly alive to the necessity of grappling vigorously with the evil of this increasing debt. In November and December, 1855, Mr. Patterson delivered a course of lectures, an example followed in subsequent years by Mr. Richard Davison, M.P., and Mr. Hyndman, by Dr. Andrews, Mr. James MacAdam, and Dr. Wyville Thomson, all of which resulted in substantial benefit to the society. Continued efforts of this kind, and obtaining new shareholders and subscribers, ultimately had the desired result, and the annual report presented to the shareholders of the Museum in May, 1866, contained the satisfactory announcement that the institution was at that time perfectly free of debt. So it has almost ever since remained ; but I regret to add that increased expenditure, without any additional income, begins again, the last year or two, to put our balances on the wrong side ; and without additional income it will not be possible for the council to continue certain new arrangements entered into during last session, with the intention of increasing the usefulness and attractiveness of the Museum, and its varied and valuable collections, which are being constantly added to, the last addition of much impor-

tance being the collection of Irish antiquities presented last year by Mr. Benn, and now deposited in the new room downstairs.

An important, but now by many almost forgotten, episode in the history of the society was what is spoken of in our records as "the Porter bequest." This was a sum of £5,000, apparently intended to be willed to the Museum by the late Mr. John Porter of this town. The validity of this bequest was called in question; and, after getting the best legal opinions obtainable on the subject, the council of the society considered that it would not be prudent to enter into litigation to support their claim. They therefore abandoned it, and, having informed the residuary legatee of their intention of doing so, this gentleman offered, on 10th May, 1868—(1) To provide cases for the proper display of the articles presented to the Museum by Mr. Porter, (2) to pay the law costs incurred; and (3) to present the Museum with a sum of £500, which offers were duly accepted. The gentleman who acted thus handsomely is my friend Mr. Edward Porter Cowan,* the present excellent and popular Mayor of Belfast.

In a brief sketch such as this of the history of the society and the Museum it is not easy to adhere strictly to the chronological order of events without increasing the tedium of the description. However, I think that, except the addition to the building, which was completed only last year, and which is so recent that it need not now be alluded to, I have mentioned the principal events in the material history if this Museum; but the moral history of the society that meets within its walls would not be so easily written. That the society has exercised a considerable influence towards the cultivation of natural science in the town and district is undeniable, and the future historian of Belfast will fail in his duty if he do not accord to many of those whose names have been mentioned here this evening the acknowledgments that are due in this regard. I feel, however, and say it with regret, that in my opinion, the society has perhaps passed the zenith of its importance; and that its influence and the interest excited by its proceediugs have latterly been on the

* Now Sir Edward Porter Cowan.

wane ; but let us hope not permanently so. For this waning interest there are many reasons, most of them arising from circumstances beyond our control. Some of these I shall endeavour to point out. Firstly, this society has now to meet not only the competing attractions of the young and vigorous Naturalists' Field Club, of which my friend Mr. Robert Young is this year the excellent president (a matter of congratulation both for the club and himself), but also those of the societies connected with places of worship in town, the young men of these congregations associating themselves with the societies connected with those churches of which they are members. Thus there is material enough to make one large flourishing society, so scattered that its energy, powerful for greater results if united, is in some degree weakened in consequence of its subdivision. Again, sixty years ago, when the society was founded, the population of Belfast did not number more than 33,000, compared with 207,000, at the present time. But then the people, professional men, merchants, traders, and others, all resided in the town, while now the large majority of these classes reside either in the country or in suburbs sufficiently distant to make it inconvenient for them to return after having left it at the close of their business day. Even the last twenty or thirty years have made a further great change in this respect. It is quite in my recollection when most of the leading members of the society resided almost within call. Now only one member of the council resides near us ; the rest are so scattered that it has become almost impossible for the council to hold their meetings for the transaction of the society's business at each other's houses, as was long their pleasant and social practice. Another and no less powerful factor in the gradual decadence of such societies is the recent enormous increase in the variety and circulation of newspapers, reviews, and periodicals of all kinds. Most of these are general, but many special, so much so that there is hardly a leading science, and there certainly is no important trade or industry, in the sister kingdom without its exponent and reflex in the press. What the *Economist* is to the banker or merchant ; the *Engineer*, the *Grocer*, or the *Builder* to those

indicated by these names ; the *Railway Times* to the director ; the *Field* to the sportsman ; or the *Era* to the actor, is the *Art Journal* to the sculptor or painter, the *Lancet* to the physician, the *Ibis* to the lover of birds, or the *Zoologist* to its namesake in the flesh. The spirit of the age sympathises with this modern luxury of different readers indulging their particular tastes at their own fireside, while it is further stimulated by the freer circulation of money as well as by the cheapness of some and the excellence of many of the periodicals in question. When it is borne in mind that the pages of some of the best modern reviews are open to men of mark in politics, religion, literature, art and science, and that the reader can thus have easy access to the contemporary thoughts of the best men of the day, in whatever direction he may choose to seek for mental recreation or relaxation, it ceases to be a matter of surprise, not only that the meetings of a society such as ours no longer possess their old charm of attracting large audiences, but that public lectures generally have ceased to be regarded as the most popular means of imparting instruction by a large majority of those for whose benefit they were intended. They no longer attract the audiences ; are voted "slow ;" and are consequently neglected for some other more attractive and amusing, even if less improving, ways of spending time, these remarks applying to other large towns as well as to our own. In confirmation of this I may mention having lately noticed an announcement of the closing of the Polytechnic Institution—long one of the most popular places of public resort in London. Here were delivered popular lectures upon scientific or semi-scientific subjects, often illustrated by attractive experiments. The Polytechnic did good work in its time : but for some years back its audiences have been declining, its work seemed to be done, and having attained to a mature old age, it lately died a natural death. Another cause, also leading in the direction we have been considering, lies in the greatly increased modern facilities for travel. But perhaps the most powerful factor of all is to be found in the greater pressure under which most of us live nowadays. The style of living among people in the same position is more expensive than

it was. Houses, equipages, dress, and entertainments are all more costly ; the working hours are shorter, while the holidays are longer ; and yet withal competition in most businesses is keener, and the struggle in what Bret Harte has so aptly described as " the fierce race for wealth " more severe than ever. Hence it comes that the exeitement of our days seems to demand a reflex of excitement in our evenings ; the quieter pursuits of former times no longer suffice for the youth of the present day, and I fear we cannot deny that the literary, scientific, and artistic character of the town has not kept pace with its rapid growth in population and wealth. The age we live in seems to be becoming more and more utilitarian ; we are forced to admit this, and having to meet facts as they are, not perhaps as we might wish them to be , it behoves us to pause and consider whether, as we cannot lead as we might like, we might not lead in the direction where we may be of most use. Whether, in fact, we cannot use our organization here, partially at least, for the furtherance of such useful objects as the material, as well as the moral and intellectual, advancement of the community ; and I believe we can aid towards the attainment of so desirable an end by encouraging communications here dealing with the application of science to, and combining of it with the practical aims and objects of daily life.

Economic geology, for instance, teaches us how best to utilize such deposits as the coal measures of Tyrone, the salt beds at Carrickfergus, and the hematite iron ore fields of Antrim. Engineering and applied mechanics serve not only to economise the use and the wear and tear of, but even to raise the value of, manual labour. The earnings of, say, mechanics or harvest labourers, or indeed of any class of workmen, have not been reduced in consequence of the invention of indoor labour-saving appliances or of reaping or mowing machines, but are higher now than formerly, while females can earn much better wages in a mill or factory or in many other ways than they formerly did while at the needle or with the spinning wheel. The discoveries in magnetism and electricity are truly marvellous, and their results are no less so. All the countries of the civilised

world are now united by materially slender, but morally powerful bonds, enabling persons in different hemispheres to converse with one another across continents and through oceans. The merchant in London can in a day buy a cargo of rice or cotton in India, or tea in China; and, on the same day, can arrange for the immediate payment of his purchase by a remittance of silver direct from San Francisco. Important transactions now are often done so closely that, in an operation of this nature, sometimes involving delicate and intricate calculations in cross-exchanges, the cost and time involved in remitting hard money from this country would often be sufficient to render the business unprofitable, if not impossible. Speaking the other day at Birmingham, the eminent electrician, Dr. Siemens, said that "that form of energy known as the electric current was nothing more than the philosopher's delight forty years ago;" and long since that period it continued to be regarded as an unmanageable element. Now it has been rendered tractable, forced to admit the superiority of its master, and even submitting to be stored and carried about for use when and where required. The importance of these discoveries is only now being brought home to some of us in the electric light and the telephone. One of the spinning mills in town is now being lit by electricity: and most of the arrangements for this meeting were made by our hon. secretary, Dr. Workman, and myself conversing freely by means of the telephone between his house in Balmoral Terrace and my office in Corporation Street, far asunder at quite different ends of the town. The high authority just named (Dr. Siemens) considers electricity destined to supply both the light and much of the power of the future.

I suppose there is no science, the pursuit of which and its application to practical objects, has done more for the benefit of mankind than chemistry. It has added to the productive power of the soil, and thus aided agriculture by ascertaining, pointing out, and supplying the constituents most wanted for the production of any particular crop; by the manufacture of phosphates, and in the utilisation of sewage, all of which tend, by increasing the supplies, to reduce the prices of food for the

masses. This, the agricultural branch of chemical science, has an able exponent in our fellow-member, one of my predecessors in this chair, Dr. Hodges. There is scarcely an important industry that has not felt the influence of chemistry ; it is brought perhaps most home to ourselves by the assistance it renders in the bleaching and dyeing of yarns and threads, linens, and other fabrics ; while in the detection of adulteration of food, impurities in water, or poisonous substances in the human frame, it comes to the assistance of the social reformer, the physician, and the jurist. This society derives lustre from the fact that it reckons among its now oldest members, and as a past president, one of the most renowned of living chemists, Dr. Andrews. Again, some branches of what is popularly known as social science, such, for instance, as sanitary reform, and education, particularly technical education, to which I purpose reverting later, would not be out of place here ; and the somewhat neglected study of one branch of zoology, I mean the natural history of fishes, might be attended to with great advantage, with the view, by the increased knowledge it would afford, to aid in the development of the undoubtedly very valuable, but only partially worked Irish fisheries. Although claiming as yet no place among the exact sciences, it must be admitted that meteorology is progressing. Within our recollection weather forecasts were regarded as little better than mere speculations, but now, that formerly mythical personage, the clerk of the weather, has both "a local habitation and a name," and the weather forecasts that daily issue from his office, although of course sometimes at fault, are so generally accurate that their value to the seafaring classes, and especially to fishermen, will not be disputed. In this connection, I think it only right to pay a tribute to the courage and devotion of Mr. Clement L. Wragge, F.R.G.S., a gentleman who has been lately carrying out a series of meteorological observations on Ben Nevis, and who, at the imminent risk of his life, ascended the mountain in the fearful storm of last Friday fortnight, the 14th October, for the purpose of taking some observations, from which his knowledge and experience enable him to draw some valuable deductions as

to the operation of those hitherto hidden laws that govern the course of storms. I might multiply examples, but these indications as to the direction in which I think we might endeavour to influence discussions here, advocating the application of scientific discovery to practical aims, may suffice for the present, and I therefore pass on to another branch of my subject.

It is generally admitted that the United Kingdom has long enjoyed a position of industrial and commercial supremacy over the rest of the world. That position she still maintains, but no longer so far ahead of some of her competitors as formerly; and it may not be unprofitable to inquire what first led to this supremacy, and why it is now threatened. On both these points, especially on the latter, differences of opinion prevail, but I believe what mainly led to it was the partly natural and partly acquired aptitude of the people to adapt themselves to circumstances, and their ability to take full advantage of the enormous mineral wealth with which the country had been so richly endowed by nature. The people, too, had plenty of working enterprise and energy, but along with this they possessed the characteristic of seeing quickly, almost by intuition, when their work ceased to be fairly reproductive, and when it was time for them to turn and change. Then there arose from time to time men of exceptional reflective, inventive and mechanical talent, whose names will be remembered as long as British science and British commerce endure; men like Watt and Arkwright and the two Stephensons, like Davy and Faraday and many others; men, I say, like these arose often to have to combat prejudices and meet opposition, but finally to conquer, and to find an army of workers ready to follow their lead and to devote their own energy to the development of our resources. Again, these countries have produced men of the most profound genius in every walk of life—authors, poets, statesmen, soldiers and sailors, historians, philosophers, artists, and scientists in all branches. It is only with some of these latter that we have now specially to deal, although all the rest, and many others too numerous to mention, have not been without much influence in moulding the national character, a pro-

minent feature in which, with, I regret to say, some foul exceptions, has ever been a love of "fair play." This latter led to an early development of our liberties, and this again to England long having been the refuge for the persecuted and the exiles of other countries. It is too much a matter of history to require further mention here how some new industries were introduced and other older ones improved by some of these refugees. It is in such ways and by such combinations of circumstances as those now briefly indicated that our national industrial character has been formed, and that character, coupled with our insular position, our mineral wealth, and other natural advantages, is what, in my opinion, has led to our commercial supremacy. Having attained to a certain position, it is the duty of every individual in the community to do what he can to maintain it. Is then our position threatened or assailed? If so, by whom, and how are we to meet and to defeat the attack? In the first place, I do not consider that it is so seriously threatened as some make out; but, granted that it is threatened to some extent, how comes it? I believe it arises from different causes in the different articles in which foreign competition presses on us most severely. In some things, such, for instance, as linen yarns and plain articles generally, the cause seems to be found in the longer hours and lower wages that prevail in the establishments of our Continental rivals. We cannot expect, nor indeed do we wish for, any retrogressive legislation with regard to hours of labour; so, I fear, unless we can further lower the cost of production, we must let those rivals keep what they have got, consoling ourselves with the reflection that what they have got is what was least worth our while to keep. In other articles, however, it is superior taste, and in others, again, superior skill and the applied results of a carefully nurtured system of technical instruction, that are causing us to feel foreign competition as we do. The advocacy of scientific and technical education comes so legitimately within the scope of our operations that I proceed to allude briefly to the subject; doing so, indeed, requires no apology, as it is one of the questions of the day. It was lately brought so fully before

the local public in a very able letter addressed by my friend, Mr. Loewenthal, the President of the Linen Merchants' Association, to that body, and shortly thereafter brought by deputation from that body before the Chamber of Commerce, that I need not now refer to it at any great length. The importance of the subject has long been recognised in several Continental countries; the result being that in chemistry, and in the arts as applied to decorative furniture and architecture, room-papers, curtain and other fabrics, whether with designs woven into or printed on them, and to other articles, we are simply beaten. The manufacturing towns in England and Scotland are now fully alive to the importance of not allowing themselves to get further behind; and, in most cases, without waiting for Government aid, the want has been supplied either by private liberality, as in the case of the Mason College at Birmingham and the intended Baxter College at Dundee, or by public subscription, as in the case of the Yorkshire College at Leeds. The large cities and towns of Glasgow, Bradford, Huddersfield, and others have schools which make weaving and designing a speciality; while Sheffield has one more devoted to its particular industries, such as metallurgy, &c. Four months ago a new university college was opened at Nottingham, part of the aim of which is the teaching of technology. The instructions in this department (as I learn from Mr. Loewenthal's letter) will embrace the manufacture of cloth, cotton, silk, lace and hosiery, bleaching, dyeing and printing, mechanics, chemistry, light, heat, steam, electricity and magnetism, machine drawing, principles of mining, and almost as many more subjects, which I do not wish to occupy more of your time in enumerating. I have to thank my friend, Mr. John Marshall, of Leeds, for kindly sending me a copy of the seventh annual report of the Yorkshire College (June, 1881); and from this I see that among many general subjects, the following are prominent:—Experimental physics, chemistry, geology and mining, and, separately, coal mining, and civil and mechanical engineering. As might be expected in Leeds, the capital of the immense woollen manufacturing industry of Yorkshire, the textile industries and dyeing departments receive

special attention. The separate report on these is a very interesting document; the weaving department had 78 and the dyeing department 58 students. The second year students made several of the coal-tar colours, starting with benzol, a most important matter, to which I purpose reverting later. Including a sum of £15,000 donation (besides an endowment of £1,250 a year) from the Clothworkers' Company of London, the public subscriptions to the general and building funds of the Yorkshire College, at the time the report alluded to was issued last summer, amounted to over £82,000! Besides the varied technical instruction given at Anderson's College, Glasgow (for the calendar of which for the present session I am indebted to Mr. James Barnett), and which includes, with special prominence, applied mechanics and chemistry, the city of Glasgow has lately established its separate technical college; but up to the present the weaving branch is, I believe, the only one that has got started. The syllabus for the present session, which I have received, shows that full practical instruction on the looms themselves, and in a great variety of fabrics, is here given. It is satisfactory to know that the authorities of Queen's College here are alive to the necessity of keeping abreast of the times in the proper teaching of those branches of science to which I have been specially alluding. The accommodation and appliances that were sufficient over thirty years ago for giving instruction in natural philosophy and chemistry are now, with the changes that have occurred within this period, no longer adequate; and it is the intention of the college authorities, supported by the Corporation, the Chamber of Commerce, and the borough members, to apply to Government for a grant of some £10,000 to provide the additional accommodation and apparatus required. On behalf of this, the oldest scientific society in Belfast, I purpose also supporting the application. In illustration of the want being actually felt, a friend of mine who was commencing a certain kind of chemical business here had to get a practical chemist as manager of his works from England.

In connection with a local bleaching and printing company,

of which I have the honour to be chairman, I lately learned some things that surprised me. When speaking just now of the Yorkshire College, I alluded to a circumstance mentioned in the report that some of the students there had made several of the coal tar colours from benzol. That statement does not convey much significance to the uninitiated without explanation. Benzol itself, as I understand, is an extract from common coal tar. What are known in the trade as the aniline colours were the first dyes produced from coal tar ; but it was found by experience that while these suited very well for silk or woollen fabrics, as they became fast without a mordant, they did not answer for goods made from hard fibres, like flax and hemp. The first aniline colour of commerce was mauve. This was an entirely new colour ; and I well remember the sensation that its appearance created three or four-and-twenty years ago. A German chemist, Hoffman, then brought out other colours, rosaniline, magenta, &c. Another extract from benzol is anthracine, and from it are derived all the so-called alizarine colours. The colour basis of alizarine is scarlet : it is largely taking the place of madder, which was hitherto the principal red dye, yielding derivatives of purples and down to chocolate colours. From the alizarine scarlet as a basis the derivatives of purples, lilacs, &c., can also be obtained. A German chemical company have lately brought out an alizarine blue which seems likely to supplant indigo, the latter being not only more expensive, but also more difficult to work. Again, we have alizarine orange, and a variety of graduated shades derived from it, down to brown. Other products from the same original base—coal tar—are ceruline, which produces a green, and mytheline green, from which also a blue can be derived. I shall go no further into details, but the examples given will suffice to show the variety and perfection of these new colours, and the reason I mention the matter at all is partly to illustrate the progress of chemical research in this particular direction, and its use to commerce, and partly to state that these colours, used so largely in our dye and print works, are all made in Germany. We in our gasworks make the coal tar from which

the anthracine is derived. The Germans import the anthracine from us, make these beautiful colours from it, and sell them back to us. We can bleach and print better than the Germans, and the finish we put upon our goods is unrivalled; but so much are we at their mercy for these colours that by a trade combination they lately advanced their prices for some of them fifty per cent.; and we are at present, and I suppose, till we make the colours for ourselves shall continue, powerless to resist. Where can we find a stronger argument than this in favour of technical education?

It is, however, not alone in manufacturing, but also in purely mercantile pursuits, that technical instruction is given on the Continent. I lately read in the *Economist* that a superior school of commercial studies, created by the Paris Chamber of Commerce, will be opened on the 3rd November. The Chamber possesses already two schools of commerce; the new one, for which a spacious building has been erected, is intended to complete the studies of the pupils in the highest branches of commercial, industrial, and financial knowledge, in order to qualify them for the direction of banks, manufactories, or public companies, or for consular posts. The teaching staff consists of thirty professors. Among the other subjects comprised in the programme are monetary systems, cheques, insurance, maritime law, bourse operations, minerals and mines, yarns, tissues, and dyes, patent laws, analyses, adulterations, &c.

We want, however, more than all that. While the school of art is doing excellent work in its way, and work too that cannot fail to be beneficial to the artistic departments of our business, we want besides a permanent art gallery, which should be supplemented by periodical loan and sale exhibitions. Access to the beautiful in art, and education by the eye, cannot fail to aid in elevating the public taste and tone; yet for any art exhibitions worthy the name this large town has for several years been indebted to the enterprise of a private firm, Messrs. Rodman, to whom I heartily wish every success in their spirited undertaking. Although a majority of our municipal authorities thought otherwise, I consider that we do want a free public library

too. Other towns of inferior size in England and Scotland have their libraries, which are largely used, and evidently highly appreciated, by the classes for whom they are intended. Leeds, for instance, a town not much superior in size to Belfast, had in its library at the date of the last report to which I had access, over 20,000 volumes in its reference department, and over 50,000 in its lending department. Four years ago, Dundee, a smaller town than Belfast, had nearly 30,000 volumes in the two departments. These have been established under the Public Libraries Acts, which some gentlemen not long since sought to have applied to Belfast.

I shall not detain you much longer ; but there is one other matter that I wish briefly to advert to. It will hardly be credited that our society's membership now is virtually no larger than it was when the Museum was built fifty years ago, and when the population of the town was less than one-fourth of what it now is. I do not expect to keep up the old proportion of membership to population ; but I regard with disappointment the apathy of the public, and with more than disappointment the not unfrequently expressed wish to put a commercial value on membership here in return for the annual subscription. We cannot offer a direct return in money, and it is very discouraging when one is trying to enlist new members to be met with such selfish remarks as "It does me no good," or "I get nothing for my money." If the Museum and the society are, as I think they are, deserving of public support, they should get it more freely and ungrudgingly than they do. Fifty or sixty more members at an annual subscription of only a guinea each would make us financially easy, but still with no margin for incidental expenses, painting or repairs of buildings, &c. It would seem strange if, in such a large community, such a comparatively small number could not be had notwithstanding all the counter attractions alluded to. However, I feel strongly that, as the Museum exists for the public, and not the public for the Museum, if the public won't support it, it will have to go down, for I do not see the object of keeping it in being by spasmodic efforts, from any mere sentimental or conservative

feeling. I confess I have been thinking that some parts of our collection—such for instance as the quadrupeds—are so incomplete as to be of little value; and the necessity for these no longer exists to the same extent as formerly, as there is now, I understand, a more complete collection of such at the Queen's College. I speak only for myself, and am not to be understood as making any proposal, as I have not mentioned the subject to my colleagues, who may entirely dissent from me; but, for my own part, I should not object to see the Museum handed over as a present to the town, as the nucleus for a Free Museum and Library. We have fine collections in ornithology, geology, Irish antiquities, foreign arms and implements, and other things; but in those departments where our collections are poor and not progressive they might, with little disadvantage, be dropped, and the space thus gained be devoted to books. There is room enough at the rere for another pretty large building, part of which might be arranged as an art gallery, and the remainder to library purposes. I apologise to my fellow-members for having said so much without first speaking to them; but they may rest satisfied that I have not compromised them or the society in any way, and what has been said may bear fruit in one direction or the other. While I should much regret to see the Museum terminate its independent existence, I should regret still more to see that existence indefinitely prolonged if the building could otherwise be devoted to more distinctly useful purposes. Such a step as the giving up the ownership and management of the Museum would by no means entail the extinction of the society, which would go on, as I hope it will in any case, prosperously and vigorously.

A great English statesman, who is a true friend of this country, alluded with regret in one of his recent public utterances to the absence of a middle class in Ireland. Such is unfortunately the case in the greater part of the country; but I claim for this town and most of the province the possession of a middle class—not so rich, truly, as the similar class in the sister island, but not inferior to them in those qualities that go to make a country prosperous and contented—I mean intelligence, indus-

try, and thrift. I have no doubt most of the proprietors of this Museum, belonging, as they do, to the intelligent class referred to, would consider the question of parting with their property, if it came to that, in no narrow spirit, but with a primary view of enlarging the sphere of usefulness of the museum, through increased opportunities of giving instruction and imparting knowledge to a wider circle than that of the society alone. With that view, and in that spirit, I submit these concluding sentences to the consideration of my fellow-members, and I thank you all very sincerely for the patient hearing you have accorded me.

6th December, 1881.

The President, R. L. Patterson, Esq., in the Chair.

A paper was read by Professor Everett, on

REMINISCENCES OF THE PARIS ELECTRICAL EXHIBITION AND CONGRESS.

My first visit to the Exhibition was on Monday morning, August 12, 1881, and on entering it I went at once to the British Office to report myself. Lord Crawford, the Chief British Commissioner, was there, with Professor Hughes, the inventor of the printing telegraph and of the microphone, whose acquaintance I had made in London two years before, on the occasion of a visit which we both paid, by invitation, to the Laboratory of Mr. Warren De La Rue, where we witnessed the performances of Mr. De La Rue's battery of 5000 chloride of silver cells, and saw the marvellously beautiful discharges in his monster vacuum tubes. I received from these gentlemen a warm welcome, combined with the information that on receiving my letter of acceptance they had written to ask me to serve as one of the ten British Jurors of the Exhibition, which letter, however, having been addressed to Belfast, had not yet reached me. The jury were to begin work on the 20th September, and continue three or four weeks. After taking a little time to consider the matter as I walked over the Exhibition, I came to the conclusion that I ought to make the most of such a splendid opportunity of seeing what was doing in the electrical world. The Congress was not to meet till Thursday, so I had Monday, Tuesday and Wednesday free to roam about in the Exhibition at my own sweet will.

The building itself, the well-known Palais d'Industrie in the Champs Elysées, is a Crystal Palace, and was built for the first French Exhibition of the Industry of all Nations. It is not near so large as the Sydenham Crystal Palace, but is perhaps 200 yards long and 80 broad—a very good size for an Exhibition, as it is big enough to hold all that one can see in reasonable time, and is not so large as to fatigue one with the mere physical labour of walking over it.

The interior presented a bright and animated appearance, even in the daytime, when there were not many electric lights to be seen, and was still more striking with the blaze of the lamps at night. It was tastefully decorated. The ground floor was parcelled out among the different nations, and could all be surveyed at a glance by a spectator in the gallery. There were electric lamps, dynamo machines, telephones, telegraphs of every form, some of them printing messages by putting down keys like the keys of a piano, some of them producing copies of pictures which were gradually built up line by line like a piece of Berlin wool work. There were sewing machines and weaving machines driven by electricity, and two great pumps pouring fourth immense sheets of a bright red liquid in a manner calculated to attract the attention of all beholders, also driven by electricity. There were baths with spoons and other articles suspended in them, undergoing the processes of electro-plating and gilding ; and large plates of pure copper, larger and thicker than any of the flagstones of our pavements, which had been deposited by the electro-metallurgical machine of Siemens. There were the newest and best forms of friction machines, and improvements on the Holtz, which render it independent of frictional aid at starting. There was the gigantic Ruhmkorff coil about six feet long, made for Mr. Spottiswoode, by Apps ; a specimen of Sir Wm. Thomson's Siphon Recorder, as well as of his large Absolute Electrometer ; cable-laying apparatus, and a beautiful model of Messrs. Siemens' cable-laying steamer, the "Faraday." There was the Phonograph, and the still newer invention, the Photophone ; while among antiquities there were gigantic electrical machines and Leyden jars

belonging to the early days of electrical invention in Holland, apparatus belonging to Volta, an autograph of Galvani, Wheatstone's revolving mirror for measuring the velocity of electricity, and Faraday's iron ring with two coils of wire wound on it, by the aid of which he made his first observation of induced currents.

Outside the Exhibition there was the Electric Tramcar, conveying passengers over a tramway a quarter of a mile long, from the Place de la Concorde to the Exhibition, and driven by an invisible influence conducted to it by means of two travelling wires, which had one end fastened to the car, while the other end travelled along a light rail suspended on posts beside the line. These two wires, it is to be remarked, did not drag the car, but were visibly dragged by it, a circumstance which brought home forcibly to one's mind the mysterious character of the unseen propelling agent. The current conveyed by these wires passed through an electromotor beneath the floor of the car, causing its armature to rotate and drive the wheels. The current itself was produced by a dynamo machine in the centre of the exhibition building, and this machine was almost precisely similar to the electromotor; for it is a general property of a large class of electro-magnetic machines that they can either be used for furnishing a current, or can themselves be driven by a current supplied to them from without.

The Exhibition was open to the public from 10 a.m. to 6 p.m., and then after being closed for two hours was open again from 8 to 11. The evening was the time when it was most crowded, and on three evenings in the week there was an extra crowd in one of the galleries, where some hundreds of people were standing in queues waiting their turn to be admitted to one of four rooms which were inscribed with the words, "Telephone de l'Opera." In each of these rooms there were twenty pairs of telephones hung on panels round the walls and having flexible wire cords attached to them, which were in communication with the Opera House, some two miles distant. On putting one of these pairs of telephones to your ears you distinctly heard the music that was being performed at the Opera;

and after hearing it for three minutes your party had to leave and make way for another detachment. One gentleman of my acquaintance heard the voice of a soprano singer with such deafening loudness that he had to remove the telephone from his ear. In taking my three minute turn I did not hear anything so loud as this, but I heard each singer well, some of them louder than others ; and what struck me most was that some of them seemed to be singing into my right ear and some into my left. The cause of this I afterwards learned, and it was just what I at first surmised. The telephone at my right was connected with a transmitter in the right hand part of the stage, and the telephone at my left ear with one in the left hand part. There are altogether ten transmitters in the opera house, five of them on the right and five on the left side of the prompter's box, just in front of the footlights, and each of these transmitters supplies eight or ten telephones in the Exhibition building. The telephonic system employed is that of M. Ader. The transmitter is on the ordinary microphonic plan first employed by Crossley, and contains several little bars of carbon, which, by their vibrations under the action of the singer's voice, cause variations of resistance in the primary circuit of a small induction coil, and thus produce currents in the secondary coil which is joined on to the line wires leading to the distant station. The receiving telephone which you hold to your ear is very compact, and is shaped something like a stirrup, consisting mainly of a steel horse-shoe magnet whose pole-pieces, round which the current circulates, are close to a thin iron diaphragm. There is one special feature, and that is that on the opposite side of the diaphragm there is a ring of soft iron passing opposite the two pole-pieces, its function being to intensify the magnetic force upon the diaphragm.

The electric lights were of two classes, which are called respectively, "arc lights" and "incandescent lights." The former are the most powerful ; the latter are the steadiest. The incandescent lamps are all very much on one plan. They contain a filament of carbon some few inches long, of about the thickness of a piece of thread, which is suspended by its two ends in

the interior of a glass globe of about one-fourth pint size, which has been very perfectly exhausted of air by means of the effective mercury pump devised by Crookes, as an improvement on the original mercury pump of Sprengel. There were four different forms of this incandescent lamp exhibited, bearing the names of Edison, Swan, Maxim, and Lane Fox. Swan's lamps, which were used for lighting the Congress Room, the British Bureau, and the Buffet, behaved exceedingly well all the time, and, as far as I could judge, were absolutely free from any flickering. Some of the others met with mishaps which prevented them from appearing to full advantage; but I believe that all of them when properly supplied with current are equally steady. Their light is yellower than that of an arc lamp, though not so yellow as gas. The little carbon filament in its incandescent condition is so bright that, by what optical writers call irradiation, it appears from one-eighth to one-fourth inch in diameter. You can light any number of them, or extinguish them instantly; and arrangements are sometimes provided by which you can turn them up or down to any degree you please by what looks like an ordinary tap. The Swan lamp has been adapted by Mr. Crompton to miners' use, and has been successfully employed in coal mines.

The arc lights require two rods of carbon, which must be a small distance apart, and the current passes between their ends, so that not only are the ends of the carbons luminous, but there is also an incandescent space of air, filled probably with little particles of carbon, between. Unlike the filament of carbon of which I have just been speaking, these carbons burn away, and need to be constantly fed forward towards each other, so as to keep them at the proper distance, on which the brightness of the light depends. This "feeding" of the carbons is effected automatically by a great variety of regulators, bearing the names of different inventors, the intention being that when the distance is too great or too small it shall immediately be rectified before the difference has produced any noticeable effect on the amount of light. But it is very difficult to do this with sufficient promptness and smoothness, and hence one can almost

always detect some fluctuation of brightness, which is often aggravated by impurities and inequalities in the material of the carbons. The diameter of these carbons is usually from quarter inch to half inch, according to the power of the lamp ; but there were one or two lamps in occasional use in the Exhibition which had carbons of an inch or inch-and-half. In a few of the systems, the carbons are placed parallel to each other with some contrivance for making the current pass across the ends and not anywhere else. In Jablochkoff's system this is secured by interposing kaolin or plaster of Paris, which reaches not quite to the ends, and burns away just as fast as the carbons ; but it was the universal verdict that of all the lights in the Exhibition, the Jablochkoff were the most unsteady. They are also said to be wasteful of power as compared with other arc lights.

But I must stop for the present my description of the objects in the Exhibition, and proceed to speak of the Congress. It was called the International Congress of Electricians, and was held under the auspices of the French Government, the Minister of Posts and Telegraphs being its President.

Communications had been addressed to the Governments of the various countries requesting each of them to appoint Commissioners whose business would be not only to select or make provision for the selection of the members to be sent from their own country to the Congress, but also to select their jurymen and look after the interests of their country in the Exhibition generally.

The French members of the Congress had a preliminary meeting, and drafted a programme which was substantially adopted. There were to be two kinds of meetings, viz. : plenary meetings, and sectional meetings, besides public lectures.

The plenary meetings were for the discussion of questions requiring an international agreement : and hence calling for a vote of the Congress.

The sectional meetings were for discussion and interchange of ideas upon various electrical questions, which might, in some instances, prepare the way for laying a resolution before a plenary meeting.

There were three sections : the first intended for the discussion of questions of electrical theory; the second for applications of electricity to telegraphy, telephony, and railway engineering; and the third for the discussion of the electric lights and other applications of electricity not included in the second section.

The general questions to be submitted to the plenary meetings were thus specified ;—

I. The discussion of the measures to be taken for arriving at the general adoption of an international system of electrical units.

II. Measures to be taken for facilitating the service of international telegraphic lines.

III. Measures to be taken for facilitating scientific international relations as regards special applications of electricity.

The Congress was opened on the 15th September, by an inaugural address from its President, M. Cochery, Ministre des Postes et des Telegraphes, and there was a splendid muster of the savans of Europe.

From Germany, we had such men as Helmholtz, Kirchhoff, Clausius, Wiedemann and Werner Siemens. From Italy, Govi, Rosetti and Ferraris. From Switzerland, Wartmann and Haggenbach. From Sweden, Nrystrom and Thalen. From Russia, Stoletow and Avenarius. From the United States, Rowland and Barker. From France, Berthelot, Wurtz, Becquerel, Cornu, Dumas, Fizeau, Jamin, Marey, Allard, Blavier, Crova, Jablochkoff, Joubert, Le Roux, Lippmann, Mascart, Mercadier, Planté, Potier, Terquem, and Violle. From England, Abel, Adams, Ayrton, Barrett, Sir Charles Bright, Chrystal, Latimer Clark, Clifton, Crookes, De La Rue, Dewar, Fitzgerald, Carey Foster, Dr. Gladstone, Gordon, Hopkinson, Hughes, Moulton, Preece, C. W. Siemens, Smith of Oxford, Willoughby Smith, Spottiswoode, Sir Wm. Thomson, and myself. The total number of members was somewhere about 300.

The Congress Room or Salle des Séances was of an ample size, and arranged so that every seat had a desk in front of it, each seat and desk being intended for two persons. The platform consisted of three tiers : the highest being for the President,

Vice-Presidents, and Secretaries ; the second (called the Tribune), was for the speaker for the time being ; and the lowest, for the Commissaire General, who may be described as the Chief Clerk. There were no stenographic reporters ; but all the front seats were allocated to La Chancellerie, that is to say, to the staff of clerks charged with the duty of taking longhand notes, and preparing an abstract of each discussion—a duty which, being able scientific men, they performed with great skill and judgment. The abstracts thus prepared were always printed and submitted for approval at the next meeting.

All the proceedings were very orderly. If anyone wished to speak, he had first to hold up his hand and say "je demande la parole" ; and on the President granting permission in the words, "vous avez la parole," he had to walk from his seat to the Tribune, and thence address the assembly in French.

After the President's opening address the hours of meeting were arranged. M. Cochery recommended us to begin every morning at eight, and this hour would have been the most agreeable to the Frenchmen ; but, in deference to the protestations of the foreigners, it was made half-past nine. This was to be the hour of meeting for the first section. The second section was to meet at two, and the third at four. This division of time appears at first sight to give an undue preponderance to the first section, but it was not so in reality : for Frenchmen leave off their business at half-past eleven and go to dejeuner.

It was well understood that the principal point to be settled by the Congress was the adoption of an international system of electrical units.

English electricians have, now for several years, been agreed among themselves in using a system, the history of which may be summed up as follows :—For a long time the standard of electrical resistance in this country as well as on the continent was what is called Siemens' unit. It is defined as the resistance at temperature 0°C of a column of mercury, a square millimetre in section, and a metre in length. The column of mercury itself was not in general use, but coils of wire were sold which were guaranteed to have this amount of resistance.

With the progress of exact knowledge, it was shown that a resistance is of the nature of a velocity, that it can be expressed as so many metres per second, and that there would be great advantages for calculation in employing units of resistance which were round numbers of metres per second. To carry out this idea, three members of a Committee appointed by the British Association carried out experiments, as the result of which they issued certain standard coils guaranteed to have a resistance of ten million metres per second. This amount of resistance has since been called the Ohm, and certain amounts of electro-motive force, of current, and of capacity, which, like the Ohm, are expressible in round numbers in the metrical system, have received the names of Volt, Weber, and Farad.

Another Committee of the British Association, subsequently appointed for selecting and naming units, recommended that everything should be based on the Centimetre, the Gramme, and the Second, and that all units directly derived from these without multiplication or division should be called C.G.S. units. They recommended that in every branch of Physics the C.G.S. units should be regarded as the chief units, though other units which are decimal multiples or submultiples of them, such as the Ohm, which is 10^9 C.G S., and the Volt, which is 10^8 C.G.S., may conveniently be used for temporary or commercial purposes.

I was the secretary of this committee, and wrote a little book illustrating the application of these recommendations to various branches of Physics. At the York meeting of the British Association I had the gratification of hearing this book commended in the warmest terms both by Sir Wm. Thomson, who was President of Section A, and Mr. Preece, the head of the Postal Telegraphs, who said it had been of the greatest possible service to him in teaching his clerks. Sir Wm. Thomson is in the habit of carrying it always in his pocket, and produced and referred to it several times during the discussions of the Congress. I was accosted in Paris by one savant after another of various nationalities who congratuated me on having produced a book which was very much wanted.

The English electricians came to the Congress with the desire of having the C.G.S. units generally adopted, together with the multiples or sub-multiples of them known as the Ohm, Volt, Weber, and Farad, which are in general use in England.

The Germans on the other hand clung to the Siemens unit, which had a German origin, and is universally employed in their country, and they were for measuring currents by the quantity of copper that a current would deposit in a given time.

The French, we understood, were on our side; but it was feared that the German patriotism and tenacity of purpose would prove formidable obstacles to a harmonious solution.

As every one felt that it would be frivolous to discuss other points till this burning question was decided or put in train for being decided, it was taken up as the first question in the first section. Sir Wm. Thomson, at the call of the President of the section, M. Dumas, opened the discussion in a very lucid and able speech, in which he paid graceful compliments to the founders of the metric system, and pointed out how that system had been developed, and in one important respect simplified by the British Association Committee. He concluded by moving that a Committee be appointed to discuss certain questions of detail, which were of too technical a character to be interesting to the members of the section generally.

He was followed by Professors Wiedemann and Helmholtz, who raised difficulties regarding the accuracy of the standards which have been constructed by the British Association, and recommended a complete separation between theory and practice—the practical unit of resistance to be Siemens' mercury unit. After one or two others had spoken, I ventured to demand "*la parole*," and threw out a suggestion which, I thought, was calculated to form the basis of a satisfactory compromise. While insisting on the importance of choosing units which had the simplest possible relations among themselves, I pointed out that this part of the work of the British Association Committees was by no means bound up inseparably with their choice of wire coils as standards, and that if a mercury standard was more permanent and more easily reproducible, there was nothing to

prevent the British Association units from being materially represented by a column of mercury instead of by a coil of wire. This is just what was agreed to in the end. (See the Resolutions at the end of the present paper.)

Altogether, the Congress had seven what were called plenary sittings—that is, meetings of the Congress as a whole. Besides these, there were six sittings of the first section and a larger number of the second and third.

Three International Commissions were resolved on. The object of the first I have already stated.

Of the other two, one was for the selection of a standard source of light, the English "candle" and the French "carcel" being both of them unsatisfactory as standards for measuring the power of electric lights.

The duties of the remaining commission are fourfold :—

(*a*) To prescribe a general plan for the observation of atmospheric electricity.

(*b*) To compile statistics relative to the efficiency of the different systems of lightning conductors, and to the question whether the networks of aerial wires which traverse our cities in connection with telegraphs and telephones are a source of danger, or of additional security.

(*c*) To systematise the observation of earth-currents through telegraphic lines.

They have, also, a fourth duty, for the imposition of which I am to some extent responsible. The circumstances were these. There was exhibited in the Belgian department of the exhibition, by its inventor, M. Van Rysselberghe, a beautiful instrument by means of which the heights of the barometer and thermometer, and four other meteorological elements* could be transmitted every ten minutes to a number of distant stations and made to record themselves there, without the assistance of an operator at either the receiving or the sending station; and only one telegraphic wire was required for the whole six instruments whose indications were transmitted. Its practical char-

* Namely, humidity, depth of water in rain gauge, direction of wind, and velocity of wind. See *Nature*, October 20, 1881, p. 588, for a fuller description.

acter was shown by the fact that every night, during a period of some hours, it was in connection with the Observatory at Brussels, and received a continuous record of the indications of the Brussels instruments.

I had studied its construction with the benefit of M. Rysselberghe's explanations, and satisfied myself that it was an invaluable instrument for enabling a director at a central station to obtain the best data for weather predictions; so when M. Rysselberghe, in the fifth plenary sitting of the Congress, described his system, and proposed that the Congress should recommend its general adoption, I was a sympathising listener.

M. Mascart, director of the French meteorological office, opposed the motion on the ground of the great expense which the general adoption of the system would involve, and the little experience that had yet been obtained of its operation.

I saw that M. Rysselberghe was not likely to get what he wanted, and I was loath to let so good a thing fall; so while M. Mascart was speaking I hastily drafted in English a resolution of a more moderate character, which, after being put into French, was unanimously adopted, M. Rysselberghe having withdrawn his own proposition in favour of it. It was, that the commission on earth-currents and atmospheric electricity be also charged with the duty of reporting on the practicability of the automatic despatch of the indications of meteorological instruments to distant stations by means of telegraphic currents.

I may add that M. Rysselberghe, before leaving Paris, gave me his warmest thanks both by letter and personally for my action in the matter.

Before the Congress had finished its sittings, the labours of the jury began. There were 150 jurors—75 for France, and 75 for the rest of the world; England having 10; Germany, 10; Belgium, 11; and the United States, 7.

Their first meeting was held on the 26th October, when they divided themselves into five groups, which at the next meeting were subdivided into fourteen classes, corresponding to the classes in which objects were arranged in the official catalogue.

I was in group 1, which included classes 3, 8, 9, 14, class 3

being magneto and dynamo machines, class 8 electric lights, class 9 electromotors and the electric transmission of power, and class 14 steam engines and gas engines which were employed for driving the above named machines. My class was No. 3, magneto and dynamo machines. Before proceeding to our separate work in the classes, we appointed (upon my proposition) three small temporary Committees to draft a plan for experimental measures in the three departments of mechanics, electricity, and optics, and I was made chairman of the electrical Committee. When these Committees had given in their Reports, one large Committee, of which I was also a member, was appointed to carry out the experiments, and these experiments lasted for several weeks, having been concluded only about a fortnight ago. For several days the fourteen classes of jurors were busily occupied in visiting the objects in their several departments, making notes as they went, and receiving explanations from the exhibitors. Then each class spent some days in deliberation and judging, the latter operation being performed by a numerical process. Each juror stated a number which in his opinion represented the merit of the object under discussion. The average of these numbers was then taken and recorded by the Chairman as the official verdict.

Our Chairman in class 3 was Professor Clausius, of Bonn, well known as one of the pioneers of the modern science of Thermodynamics. We also numbered in our ranks, Professor Amsler, of Schaffhausen, inventor of the well known planimeter; Professor Kundt, of Strasbourg; Professor Potier, of the École Polytechnique ; Terquem, of Lille ; Ferraris, of Turin; and Rowland, of the Johns Hopkins University, who was afterwards replaced by Michelson, the measurer of the velocity of light. The only Englishman besides myself was Major Armstrong, who was well versed in the subject from having superintended the experiments of the English Government on the Electric Light at Chatham.

Our Secretary was an Italian Captain of Engineers, Botto by name, who was exceedingly fluent in the French language, and had made a special study of the subject of our class, having

written a history of magneto and dynamo machines. We worked most harmoniously together, and there was very little tendency to national partizanship.

The Classes reported their judgments to their respective Groups, and the results were finally revised by the whole jury. The number of gold medals awarded was 79 ; of silver, about 150 ; and of bronze, about 250. The highest distinction of all, not counting the complimentary awards to governments and societies, was the Diploma of Honor given to inventors. Of these there were only 11, which were awarded to Sir Wm. Thomson, Dr. Werner Siemens, Professor Hughes, M. Gaston Planté, Mr. Edison, Professor Graham Bell, M. Gramme, Professor Pacinotti, Professor Bjerknes of Christiania, M. Marcel Depretz, and M. Baudot. Most of these names will be well known to you, but the last three or four are probably unfamiliar. M. Baudot is the inventor of a very elaborate method of sending several telegrams at once, and making them print themselves in Roman letters. M. Marcel Depretz has paid great attention to the theory of the distribution of electricity, and was the organiser of a large proportion of the electrically driven apparatus in the Exhibition. Professor Bjerknes was the exhibitor of some very striking experiments on mutual attractions and repulsions between vibrating bodies immersed in a liquid. He had little drums, with indian rubber ends, which were made to bulge out and draw in with rapid alternation by means of quick-acting pumps which alternately forced air in and withdrew it several times in a second. The little drums, being immersed in water, attracted one another when their phases of vibration were similar, and repelled when they were opposite. He had many other experiments on the same subject, the action in some being directive rather than attractive or repulsive. The connection between these experiments and electricity consisted in an analogy which they were supposed to bear to electricity and magnetic actions. They were supposed, indeed, to throw some light on the nature of electricity. They were certainly very suggestive.

Some of you will remember the name of Pacinotti in con-

nection with a lecture which Dr. Andrews gave in this room on the Gramme Machine. He was the first inventor of the ring armature, which was afterwards reinvented and made a great commercial success by Gramme. Pacinotti's original machine, and two others subsequently constructed by him, were exhibited in the Exhibition: and special attention was called to them by a lecture given upon them by Professor Govi, at a meeting of the Society of Telegraph Engineers which was held in the Congress Room. The question of priority was established by Pacinotti's description of his first machine in the "Nuovo Cimento" for 1864, which was put in evidence, and the machine itself was carefully examined. Dr. Andrews gathered from the information at his disposal that the contacts for collecting the currents were made in the wrong places, but this impression was erroneous, the contacts are made at the right places, and it is clear that Pacinotti well understood the theory of the machine. He was present at Professor Govi's lecture, and I met him several times afterwards.

As to addressing an audience in French, it is an exceedingly formidable thing to contemplate for the first time, and I almost shuddered at my own hardihood when I first said "je demande la parole," and proceeded to the tribune to address an audience comprising the most eminent men of science of France and the Continent. It was like plunging into deep water without knowing whether I could swim; but after the first shock was over I enjoyed the excitement; and as the vocabulary of the subject under debate had become familiar to me by listening to previous speakers, my course was tolerably easy after I was once started. The report in the official procès-verbal, as well as the resumé with comments in *La Lumière Electrique*, showed that I succeeded in making myself understood.

Indeed, I think that as a rule the English and German speakers were better understood than the French; most of the latter spoke too fast and in too low a voice to be clearly heard.

The leading spirit in the Congress was unquestionably Sir Wm. Thomson. His masterly acquaintance with the various subjects which came under discussion was very conspicuous, and

the spendid pluck which he evinces alike in attacking a scientific difficulty, or in plunging into the intricacies of a French sentence, carries all before him. He told me he had never addressed an audience in French before, but he is evidently thoroughly at home in French scientific terminology; and his clear ringing voice was of great advantage in the Congress Room, which, having a lofty canvas roof, and draped walls, was very stifling to sound.

Next to him was Professor Helmholtz, who has likewise a masterly acquaintance with every branch of Physics.

Among the Frenchmen M. Mascart appears to be the leading spirit. He is an energetic man of business, a ready and lively speaker, with a particularly clear articulation, and has done some good work in inventing and simplifying apparatus for the observation of atmospheric electricity. He is young enough to have a long future before him, and he has taken the leading part in putting his countrymen *en rapport* with the progress of electrical science in England. He is Regnault's successor at the Collège de France.

M. Cornu, of the Ecole Polytechnique, is another rising man.

The venerable M. Dumas, one of the two perpetual secretaries of the Academy of Sciences, made a very popular President in the first Section of the Congress as well as in the first Group of the Jury.

M. Cochery, who was Minister of Posts and Telegraphs in two Cabinets, and now retains the same office in a third, is an able administrator, and took us rapidly through our business in his discharge of the duties of President of the Plenary meetings. I seem still to hear his cheery voice putting questions to the vote, in the words, "Ceux qui sont de cet avis veuillent bien lever les mains."

I had once the honour of dining at his official residence with a party of eighty, and he also favoured me on one occasion with a ticket admitting six to the Ministerial box at one of the theatres.

I met numerous old friends with whom I had much pleasing intercourse, and made several new friends both among my own nation and foreigners.

It affords me much satisfaction in looking back upon this active period, when there was necessarily much discussion and difference of opinion, to reflect that I cannot recall a single instance of an unkind word given or received, and that some of those with whom I had the keenest controversy were afterwards the most marked in their demonstrations of friendship.

[Reference may be made to an article in *The Times*, of June 13, 1882, page 4, by the author of the present paper, for an account of the various kinds of magneto and dynamo machines.]

Resolutions adopted by the International Congress of Electricians at the sittting of September 22nd, 1881.

1. For electrical measurements, the fundamental units, the centimetre for length, the gramme for mass, and the second for time, are adopted.

2. The Ohm and the Volt (for practical measures of resistance and of electromotive force or potential) are to keep their existing definitions, 10^9 for the Ohm, and 10^8 for the Volt.

3. The Ohm is to be represented by a column of mercury of a square millimetre section at the temperature of zero centigrade.

4. An International commission is to be appoined to determine, for practical purposes, by fresh experiments, the length of a column of mercury of a square millimetre section which is to represent the Ohm.

5. The current produced by a Volt through an Ohm is to be called an Ampère.

6. The quantity of electricity given by an Ampère in a second is to be called a Coulomb.

7. The capacity defined by the condition that a Coulomb charges it to the potential of a Volt is to be called a Farad.

10th January, 1882.

The President, Robert Lloyd Patterson, Esq., in the Chair.

A Paper was read by Joseph J. Murphy, Esq., F.G.S., on

THE RAINY OR POST-GLACIAL PERIOD.

The views of the lecturer on the nature and cause of the glacial climate were submitted to the Society, on the 1st Dec., 1875, and on the 21st December, 1880;—both papers were fully printed in the Proceedings, so that it is not necessary to say anything here respecting the astronomical causes of glaciation. It is enough to repeat the conclusion there stated, that glaciation was due neither to great winter cold nor to low mean annual temperature, but chiefly to a cold summer which left the snow of winter unmelted, and partly to a great snowfall during winter. If any form of the astronomical theory of glaciation is true, the whole earth was never glaciated at the same time, but the northern and southern hemispheres were glaciated alternately; the epochs of maximum glaciation of the two hemispheres being separated from each other by an interval of 10,500 years. In each hemisphere there was consequently a succession of glacial periods, with a succession of non-glacial periods alternate with the glacial ones. Mr. Croll, in his work on *Climate and Time*, has submitted evidence of this intermittent character of the glacial climate.

On the astronomical theory of the glacial climate, these alternate glacial periods in the two hemispheres succeeded each other during the continuance of a much longer period, during

which the excentricity of the earth's orbit was unusually great. Of course, the excentricity, and with it the intensity of the recurrent glacial periods, increased and decreased gradually; and the glacial periods which occur while the excentricity is attaining, or has passed, its maximum, and which consequently never attain a maximum of glaciation, are what I call rainy periods. In strictness, the title of this paper ought to be "The rainy, or pre- and post-glacial periods"; but I say post- rather than pre-glacial, because pre-glacial deposits, or any evidence of the pre-glacial state of things on the surface of the earth, are likely to have been destroyed by the glaciers of the period of maximum glaciation; while the surface of the earth has been in many places preserved just as it was when the glaciers of the last glacial period disappeared.

As a rainy period was only an imperfectly developed glacial period, it follows that, in each hemisphere, rainy periods were alternated with dry or at least not-rainy periods; and I have now to state what appears to be geological evidence of this. Professor Blytt, of Christiania, appears to have discovered in the great bogs of his own country evidence of alternate wet and dry periods of considerable length, and beginning from the subsidence of the last glacial period. The following is from *Nature*, of 29th December, 1881:—

"In a recent number of *Naturen*, Prof. Axel Blytt concludes the highly interesting series of papers in which he has at some length expounded his theory of the immigrations into Norway, of different floras, during early dry and wet periods. On carefully examining the oldest Norwegian turf-bogs, he finds, as Prof. Steenstrup has shown in Denmark, that four distinct turf layers may be traced, between which there are frequently two or even three equally distinct deposits, composed of the roots and other remains of trees. The latter are found *in situ*, and by the undisturbed condition of the turf-beds above and below them, they afford a conclusive proof that such severed trunks cannot have been cut down by human agency. These separate tree-beds the author regards as mementoes of long periods of dryness, which may have endured for thousands of

years, and during which the formation of turf was arrested, to be resumed again when a wet period supervened. Such interrupted periods of dryness and wet he considers to be closely related to the several long-interrupted glacial periods which, according to Geikie, have succeeded one another. In accordance with Herr Blytt's view, the close of the first glacial age was followed by a dry period, in which an Arctic flora appeared in Scandinavia, traces of which, as leaves of *Dryas octopetala* and *Salix reticulata*, have been found in the clay underlying the bogs in Denmark and Southern Sweden, in the latter of which the same flora is to be seen interposed between two ancient moraines. The boreal flora, the author is of opinion, we may refer to a dry period, characterised by great summer heat; and in the deposits belonging to this age we find abundant remains of such deciduous trees as the hazel and the *Prunus avium*, which are now of rare occurrence in Norway, while many other vegetable forms represented in these beds have been long extinct. The differences observable in the bogs of Denmark and Norway, Herr Blytt refers to the fact that while the former has undergone very little if any elevation, the latter has risen since the glacial age 600 feet above the level of the sea. In Norway the formation of the turf-beds may be gauged by their varying elevations. Thus in South-east Norway, where the old sea-level has been raised to a height of 600 feet, the turf is from 20 to 26 feet deep, while at low levels, as 30 feet above the strand, the bogs are seldom more than from two to four feet deep."

In Sir Joseph Hooker's address to the Geographical Section of the British Association, in 1881,† he thus resumes Professor Blytt's facts respecting the stratification of the bogs:—

"The proofs of the alternating wet and dry seasons rest on the fact that the different layers of peat in each bog present widely different characters, and these characters recur in the same order in all the bogs. First, there is a layer of wet spongy peat, with the remains of bog mosses and aquatic plants; this gradually passes upwards into a layer of dry soil containing the remains of many land plants and prostrate trunks of trees,

† Reported in *Nature*, 8th September, 1881.

showing that the country was forested. To this succeeds wet spongy peat as before, to be again covered with dry peaty soil and tree-trunks, &c., and so on."

Respecting the great precipitation of the glacial climate—including in precipitation, of course, both rain- and snow-fall—I take the following evidence from Professor Geikie's paper on "The Geysers of the Yellowstone," in *Macmillan's Magazine*, May, 1881:—

The Great Salt Lake of Utah, North America, is 5,250 feet above the sea, and is at present without outlet, and only 80 miles long by 52 broad. But at a height 940 feet above its present surface, a terrace has been discovered which is without doubt an ancient shore of the lake, and corresponds in height with a gap in the rim of the lake-basin, by which the lake overflowed in a river which was a tributary of the Snake River or Upper Columbia. An examination of the terrace shows that the lake then extended 300 miles by 180, so that its area was then, speaking roughly, about twenty times what it is now. The moraines of ancient glaciers show that the glaciers which produced them came down to the lake from the Wahsatch mountains, which are only about 3,000 feet higher than its surface at that time. Freshwater shells are found along the terrace, but they are not needed to prove that a lake with an outlet must have been of fresh water.

We see from these facts that whereas the precipitation of Salt Lake Basin is now carried off by the evaporation of the Salt Lake, at a recent geological period, which was probably the glacial, the precipitation of the same area filled a lake of twenty times the extent, and was not all carried off by its evaporation, but part of it overflowed in a river. This proves either that the quantity of precipitation must have been much greater than now, or the force of evaporation much less;—probably both.

7th February, 1882.

The President, Robert Lloyd Patterson, Esq., in the Chair.

Professor Letts, Ph.D., F.R.S.E., read a Paper on

THE DIAMOND.

The Diamond, on account of its great beauty, rarity, and extraordinary hardness, has been held in high estimation from very early times. The word diamond is derived from the Greek "adamas," indomitable, a term applied to it on account of its real property of extraordinary hardness and its supposed property of resisting fire—that is, of not becoming hot when heat was applied to it. But its hardness was exaggerated by the ancients. For instance, Pliny says: "The best of all these diamonds is made upon an anvil by blows of the hammer, and their repulsion for iron is such that they make the hammer fly in pieces, and sometimes the anvil itself is broken." This statement is still believed in by some people, and has occasioned a considerable loss of property.

By the ancients precious stones were regarded as possessing supernatural powers, and they were accordingly employed as talismans, each species possessing its own peculiarities. The diamond was carried as an antidote to poisons and a preservative against insanity. As an ornamental stone, the diamond was highly esteemed during the early times of the Roman Empire. As early as the first century diamonds had already been brought from India, and from that time till the eighteenth century, practically, the whole supply of diamonds was brought from the

East Indies. The most celebrated of all the Indian diamond mines were those in the neighbourhood of Golconda, near Hyderabad, which have yielded the finest diamonds in existence ; among others, the Kohinoor. In the 17th century as many as 60,000 people were employed in the mines of Golconda, and in the 13th century upwards of 400lb. of the precious stones which had been taken from the mines were stored in Sultan Mahmoud's treasury. The Golconda mines were ceded many years ago to the English, but they are believed to be exhausted, and have long since been abandoned.

In the 18th century diamonds were discovered in Brazil by gold-seekers, who were in such ignorance of their nature that they employed them as counters in card-playing; but at last a native, Bernard Lobo, who had visited the East Indies, recognised the true nature of the counters, and immediately the news spread like wildfire, occasioning a panic in the diamond market. Upon the inhabitants of the diamond district the discovery acted like a curse, and to the bitter sorrows of persecution were added the horrors of earthquake and drought. The existence of diamonds in South Africa had been several times asserted before the English conquest of Cape Colony. The re-discovery, however, took place in 1867. At that date a shrewd trader, passing through a country forty miles to the west of Hopetown, saw the children of a Boer called Jacobs playing with pebbles picked up along the banks of the Orange River. Struck with the appearance of one of the playthings, the trader told Jacobs that it reminded him of the white shining stones mentioned in the Bible. As he uttered the words, an ostrich-hunter named O'Reilly chanced to pass the door-way of the house, and overhearing the remark, he entered, and was also impressed. Vague ideas of a diamond, which none of the three had ever seen, passed through their minds. They tried the pebble upon glass, scratching the sash all over. A bargain was struck ; O'Reilly took the stone for sale, each of the parties present to have a share. At Capetown, on the verdict of Dr. Atherstone, Sir P. E. Wodehouse gave £500 for it. The news spread fast.

At the moment of this discovery there was something exceed-

ing a panic in the colony. Wool, the staple product of the colony, was at a hopelessly low price ; a murrain was thinning the sheep ; never had merchants known such a time of anxiety ; and this great excitement overtook the colony, and search was made for diamonds in all directions. In 1869 a Hottentot shepherd discoverd the far-famed "Star of South Africa." He first offered it in a store for £200, but the assistant, in his master's absence, refused the offer ; eventually he sold it for £400 to the trader who saw the Boer's children playing with diamonds. The fortunate purchaser disposed of it next day for £12,000. In December, 1870, it was whispered that the children of Duboit, a Boer, were in the habit of picking up diamonds on their father's farm, which was situated twenty miles from any river. The farm was "rushed," and thousands of diamonds were soon unearthed from these "dry diggings" or beds, in which many believe the diamond was created. A tremendous rush to the diamond fields occurred, adventurers crowded thither from all parts of the world, and with such extraordinary rapidity that in 1872 there were 50,000 souls engaged in digging. An eye-witness says that about this time New Rush alone was yielding from £12,000 to £15,000 a day. One of the most striking peculiarities of some of the African gems is their liability to crack or explode spontaneously. Some Indian diamonds also have been known to explode.

Diamonds have been found in other places besides those I have mentioned. It has been stated that a diamond was once found in a brook in Ireland, but the statement requires confirmation.

The lustre of the diamond, or the manner in which light is reflected from its surface, is very characteristic, and is one of the reasons of its popularity as a gem. The diamond possesses another optical property in a high degree, a property in which it is prominent among precious stones—the power of changing the course of a ray of light. The extreme hardness of the diamond affords a ready means of distinguishing between it and other stones. But, although very hard, the diamond may be broken into fragments in a steel crushing mortar, and the frac-

ture of the diamond thus effected occurs in directions parallel to the faces of the octahedron, which proves the octahedron to be its primary form. A great many crystals admit of being fractured in certain directions, which are, therefore, called planes of cleavage. Advantage is taken of the brittleness of the diamond in roughly shaping it previous to its being polished.

The colour of the diamond is a matter of considerable importance as regards its value. When the diamond is colourless and perfectly transparent, it is said to be of the "first water," and is highly prized. But it frequently happens that the stone is slightly yellow or brown, technically called "off colour," and this is especially the case with Cape diamonds. An "off colour" stone is, comparatively speaking, of little value, unless the tint is very pure. Diamonds are sometimes found coloured green, blue, rose, and even black. They then become fancy stones, and their value is greatly beyond the first-water gems. The lovely blue diamond formerly owned by Mr. Hope, and called the Hope diamond, is quite unique. I believe it was purchased for £18,000, and sold to the Duchess of Newcastle for £25,000. Its value may be even greater. The colour of certain diamonds may occasionally be modified by heat, and a remarkable example of this was observed in France some time ago.

Months of labour, even years, with the improved machinery of the present day, must be expended on a stone of large size in order to convert it from the rough natural form into the polished brilliant. During the whole of this time, the greatest care must be bestowed on the manipulation, as a single mistake would mean the depreciation of the value of the stone to the extent of hundreds or even thousands of pounds. The natural shape of the diamond is but little fitted for displaying the full beauties of the stone, and it generally happens that the diamond in its rough form has certain imperfections which greatly detract from its appearance. The object of the diamond cutter is to remove those portions of the jewel in which the flaws occur, to give the crystal a symmetrical and elegant shape, and, by multiplying the faces of the diamond, to cause it to reflect as much as possible of the light which falls on it, and

thus to produce the beautiful flashing effect and play of colours which can be obtained with no other stone, at least to nothing like the same extent, owing to its great refractive power. Diamond cutting and polishing were practised in India and China long before its introduction into Europe, which is stated to have been done by Louis de Berguem, an inhabitant of Bruges, towards the latter part of the 15th century. At all events, he appears to have been the first to employ a polishing wheel with diamond dust, and, when suggested, a suitable arrangement of facets for displaying in a high degree the reflecting and refracting powers of the diamond. Berguem's pupils emigrated to other European towns, and established workshops for cutting the diamond; and at the present day such workshops can be found in London, Paris, New York, Boston, and especially Amsterdam, which is the seat of the diamond cutting industry, and in which the largest establishment for the purpose exists, namely, that of Mr. Coster. The diamond is cut in several different forms, but only two of these, the brilliant and the rose, are common. The brilliant is derived from the octahedron, the natural form of the diamond, by replacing the point of intersection of four of its edges by one or by several faces. The brilliant complete has 66 faces. In the rose one surface is quite flat; the other is convex, and is divided into a variable number of facets. The Holland Rose has 24; the semi-Holland, 18 to 20.

The operations by which the rough diamond is fashioned into the brilliant, rose, or other form are splitting, cutting, and polishing. In splitting the diamond it is first embedded by means of cement into a wooden handle, and the workman then scratches a deep V-shaped notch on its surface at the place where he wishes the fracture to occur. This he does by means of a sharp-pointed diamond, which is fixed into a handle. When the notch is sufficiently deep, the handle embracing the diamond is placed in a hole in a block of lead, and with one hand the workman applies the edge of a small steel ruler to the notch, whilst with the other he gives a tap to the ruler, and the stone is split. A spectator says: "It is not without emotion that

one sees the blow given, for the slightest error may prove fatal to the value of the diamond for ever; but it is given without hesitation and with perfect composure. The future of a rough diamond is very much at the mercy of the splitter; for it is he who decides what shape the stone is to take, and how the flaws and other imperfections are to be removed so as to retain the utmost weight with the most brilliant effect. The split diamond is next passed to the cutter, who operates upon two stones at the same time, each being cemented into wooden handles. These he grinds together, so as to accomplish their mutual smoothing. His labour, which is of a very heavy description, has given rise to the saying, 'diamond cut diamond.' The cutter, having roughly fashioned the diamond into the desired form, passes it to the polisher, whose business it is to smooth the rough parts which the cutter has formed, and to give each a bright polish. The diamond is first embedded with great care and judgment in an oval mass of tin and lead to serve as a support, this in its turn being fixed into a brass cup, which is provided with a handle. The polishing wheel consists of a disc of steel, revolving in a horizontal direction at a speed of 2,000 revolutions per minute. The polishing is effected by smearing this wheel with diamond powder and oil, and then pressing each part of the diamond against it. The eyes of the polishers seem of little use compared with their sense of touch, which has been exquisitely educated. It is by the instinct of their finger ends that the point of the diamond is adjusted with determinate exactness of position to the face of the revolving disc."

It is now time for me to tell you the histories of some of the more celebrated diamonds, several of which are quite romances, and unfortunately, too often tragic ones. Of course such a theme has not escaped the notice of the novelist, and in support of my statement I need only remind you of Wilkie Collins's celebrated book "The Moonstone," the plot of which is concerned with the diamond which is now in possession of the Russian Crown, and is called the Orloff. It is the most remarkable of the Crown jewels of Russia, and forms the end of

the Imperial sceptre. It is of Indian origin, and for a century and a half formed one of the eyes of the famous idol Serringham or Sherigam, in the famous temple of Brahma, another and similar diamond forming the second eye. At the commencement of the eighteenth century, a soldier, who was one of the French garrison in India, determined to get possession of both eyes of the idol. With this object he pretended to be a convert to the Hindoo religion, and to show extraordinary zeal in its behalf. Eventually he so cleverly imposed on the priests of the temple that he was entrusted with the care of the temple. He waited patiently for his opportunity, and on a dark and stormy night he succeeded in wrenching one of the eyes from its socket, but failed in his attempt to remove the other. Taking to flight, he reached Madras, where he disposed of the diamond to a captain in the English navy for £2,000. On its arrival in England the diamond was purchased for £12,000 by a Jewish merchant, and sold by him to Catharine II. for £4,000 and a title of nobility.

Another diamond with an interesting and romantic history is the Sancy, which is not cut as a brilliant, but in a special and peculiar manner, and is said to have been the first stone cut in Europe, the act having been accomplished by Louis de Berguem. Charles Duke of Burgundy wore it in his helmet at the battle of Morat in 1476, and after the Duke's defeat it was found in the battle-field (another account says removed from the corpse of Charles) by a Swiss soldier, who sold it to a priest for a couple of francs. It was not heard of for some time, but in 1589 it was pledged by King Anthony of Portugal to De Sancy, a Huguenot gentleman, and treasurer of the King of France, who retained it in payment of 100,000 livres. In this family it remained until Henry the Third commissioned a descendant of the purchaser to raise recruits in Switzerland ; and very shortly afterwards, driven from the throne by his subjects, the King borrowed the stone to pay his troops, but the servant who was carrying it to the King disappeared, and was not heard of for some time. At last it was discovered that he had been assassinated in the forest of Dole, and buried in a native village. "Then, my

diamond is not lost," said De Sancy, and so it turned out, for it was found in the stomach of the faithful servant. In 1792 the Sancy once more disappeared, and was found by the Paris police.

The next celebrated diamond I have to mention is a brilliant of almost unrivalled beauty called the " Pitt," or " Regent," which is in possession of the French Government. It was found in the mines of Parteal, near Golconda, in 1702, by a slave, who, in order to conceal it, wounded himself in the thigh, and hid the diamond in the wound. He promised the stone to a sailor if he would gain him his liberty. The sailor got the slave on board, then took the diamond from him, and drowned the unfortunate wretch. The sailor sold the stone to Pitt, grandfather of the Earl of Chatham, and Governor of Fort St. George, for £1,000; then spent the money, and eventually hanged himself. Pitt sold the diamond to the Duke of Orleans (Regent of France during the minority of Louis XV.). Since then the "Regent" has had many curious adventures, and has passed very literally through many hands. For in the days that followed the fall of Louis XVI. the "Regent," carefully chained and guarded by gendarmes, was exposed to the people of Paris, and every half-starved workman who chose might hold the symbol of Royal splendour in his hands for a few minutes. The "Regent," pawned to the Bavarian Government by Napoleon I., stolen by robbers, and its hiding place revealed at the gate of death by one of the reckless band, and mounted in the state sword of Napoleon I., glittered in the imperial diadem through the palmy days of Napoleon III., and is now likely to pass through a new cycle of adventures, as it is to be disposed of with the other jewels of the French Crown.

The history of one more celebrated diamond must detain us for a few moments, that which is the chief ornament of our own crown and which glitters in it along with many other gems. Every one of you has heard of the Kohinoor, or "mountain of light." The history of it is obscure, and is traced back to the legends of India. According to one of these it was worn by Carna, one of the heroes of the Indian epic poems, and if this is

the case it must have been unearthed about 4,000 years ago. It was in possession of the Rajah of Ujazin, 56 B.C. It was regarded as a talisman of power, and was always the booty of the conqueror. It passed to the Sultans of Delhi, and at length came into the possession of Runjeet Singh, and in 1850, after the formal cession of the Punjaub to British India, it was presented to Lord Dalhousie as Viceroy to her Majesty. In its original form as brought from India the Kohinoor was valued at £140,000. It had several surface flaws, and was by no means of an elegant shape. It was therefore decided to re-cut it, and it was sent to Cosler's establishment at Amsterdam in 1852. The Duke of Wellington was the first to place it on the cutting wheel, and, after thirty-eight days' of incessant labour, the diamond was fashioned into a magnificent and perfect brilliant, but its weight was reduced from $186\frac{1}{16}$ to $122\frac{3}{4}$ carats. However, the improvement in its shape and brilliancy fully compensates for this.

The "Hope" diamond is quite unique, as it is of a beautiful sapphire blue colour. Its weight is $44\frac{1}{8}$, carats, and it was purchased by Mr. Thomas Hope for £18,000. It has been sold to the Duchess of Newcastle for £25,000. Among the diamonds found in Brazil is one which belongs to the King of Portugal. It is said to weigh 1,680 carats, and in Brazil its value is estimated at three hundred million pounds; but it has been suggested that this diamond is topaz, in which case the millions vanish.

The concluding portion of the lecture consisted of a sketch of the diamond from the chemist's point of view, showing that chemists had demonstrated it to be carbon:—"As to the origin of the diamond there is little to be said, for nature seems to have decided that the operations which she employed for producing it shall remain a mystery. Many attempts have been made to obtain the diamond by artificial processes, and I venture to think that if chemists have not triumphed already, they will do so eventually. Whether diamonds will ever be obtained of large size artificially is a question that time alone can decide."

7th March, 1882.

The President, R. L. Patterson, Esq., in the Chair.

A Paper was read by Professor Cunningham, M.D., F.L.S., on

CORALS AND CORAL ISLANDS.

ABSTRACT.

After a reference to some popular misconceptions with respect to the nature alike of corals and coral-forming animals, and a short notice of certain calcareous bodies, animal and vegetable, liable to be confounded by the uninstructed with these formations, it was stated that all true corals were the internal secretions of animals included in the sub-kingdom Cœlenterata, the great majority being the skeletons of Actinozoa, while a certain number, as revealed by recent researches, are those of Hydrozoa.

The Actinozoan corals were first treated of, the typical structure of an Actinozoon, as illustrated by a common Actinia or Sea-Anemone, being described ; and it was shown that, in accordance with the number of tentacles and of the vertical radiating partitions (or mesenteries) of the body-cavity, the members of the class might be included in one or other of two groups—*i.e.*, those possessed of numerous tentacles and mesenteries (*Polyactinia* or *Zoantharia*), and those with only eight tentacles and eight mesenteric folds (*Octactinia*, or *Alcyonaria*).

Of the coralligenous Polyactinia, some resemble the Sea-Anemone in being *solitary* animals, each living being having a

separate and independent existence, and developing a simple coral in its body-wall, while the larger number are social, being composed of numerous living beings in organic union with each other. In this latter case we meet with a compound coral, certain parts of which are formed in the bodies of the various members of the colony, while others are the secretion of the soft bond of union which binds the colonists together.

The more important points of the structure of simple and compound Polyactinian corals were indicated, and it was pointed out that in the same manner that a hexamerous symmetry was usually distinguishable in the number of the tentacles and mesenteries, the hard septa or vertical radiating portions of the coral exhibited a corresponding arrangement. Notice, however, was taken of the fact that in a considerable number of extinct forms of Polyactinia (those designated Tetracoralla or Rugosa) the septa formed multiples of four, and that in some of the species the coral exhibited the singular peculiarity of a calcareous plate or operculum, with which its calice was closed.

The Octactinian corals were next examined, and the various modifications examined. Beginning with the very rudimentary peculiar skeleton of *Alcyonium*, the various forms of skeleton possessed by the *Pennatulidae*, *Gorgonidae*, *Tubiporidae*, and *Helioporidae* were exhibited and described ; and reference was made to the important discoveries of Professor Mosely in connection with the last family.

The first part of the lecture was brought to a conclusion with a brief notice of the Hydrozoan corals, of which two recent families, *Milleporidae* and *Stylasteridae*, are now known ; and it was stated as not unlikely that the problematical extinct *Stratoporidae* belonged to the same class.

The second portion of the lecture was occupied with a *resumé* of some of the more important points connected with the structure, the geographical and bathymetrical distribution, and the growth of coral reefs ; a sketch of Mr. Darwin's hitherto generally accepted subsidence theory being given, and certain objections to it recently advanced by Mr. Murray, of the Challenger expedition, shortly noticed.

Corals of one kind or another are more or less plentiful throughout the seas of the globe, but the reef-forming species are restricted to certain regions, and the areas which they occupy are determined by the temperature of the ocean, depth, nature of the shore of the adjoining land, and other circumstances. All appear to require an equable and elevated temperature in order to flourish—this temperature, according to Dana's observations, being not below 68° F. Further, no reef-form seems to be capable of living and thriving, except at depths exceeding 20 to 40 fathoms; and in some cases the growth of reefs appears to be prevented by the nature of the coast, though additional researches are required on this point.

Navigators have been long accustomed to divide coral reefs into three groups, namely, *fringing* or *shore reefs*, *barrier reefs*, and *atolls*, or *lagoon islets*. Of these, the first are found skirting the coasts of islands and continents at distances varying from less than half a mile to one or two miles. The outer portion of such reefs is higher than the inner, in consequence of the stronger corals growing more vigorously where they are exposed to the wash of the waves, and the channel between the reef and the land has in most cases a sandy bottom. The second class (barrier reefs) either extend in straight lines in front of the shores of a continent or great island, or encircle smaller islands, being separated from the land by a broad and rather deep channel, the calm water of which usually presents a striking contrast to the violent surf which breaks on the outer margin of the reef. In some cases the entire line of reef is converted into land, but usually only limited portions of it are so, assuming the form of low islands more or less clothed with vegetation, of which the cocoa-nut palm is a prominent feature. The last kind of reefs—atolls, or lagoon islands—are annular in form. They vary much in dimensions, and surround calm expanses of water destitute of islands. A considerable portion of their surface is raised above the sea-level, usually presenting the appearance of a chain of small islets.

A considerable number of theories have been advanced to account for the different peculiarities of these three kinds of

reefs. Mr. Darwin's attention was attracted to the subject in the course of his voyage in the Beagle, in the years 1831-6, and his theory is based upon the facts—firstly, "that reef-building corals only flourish at a very limited depth; and secondly, that throughout areas of vast dimensions none of the coral reefs or coral islets rise to a greater height above the level of the sea than that attained by matter thrown up by the winds and waves." These reefs, consequently, must have foundations; and what is their nature? Are they formed of great banks of sediment, or do they consist of solid rock? Mr. Darwin contended that the form or disposition of the groups of atolls afford no countenance for the first suggestion, and that the latter alternative must accordingly be adopted. Fringing reefs present no difficulties for solution, as they simply occur in those limited depths where coralligenous Actinozoa are capable of flourishing, and barrier reefs and atolls represent successive stages of subsidence of the floor on which fringing reefs were erected. As the foundation sinks the coral-formers are obliged to build upwards to maintain the level at which they can exist. The upper parts of such reefs are, then, the living portions, being built upon the skeletons of their predecessors. The above view of the formation of the varied forms of coral-reef, although very generally adopted, has not, however, satisfied all those naturalists who have bestowed attention on the subject; and Mr. Murray has recently stated, as the result of his observations on board the "Challenger," that he has arrived at the conclusion "that it is not necessary to call in subsidence to explain any of the characteristic features of barrier reefs or atolls, and that all these features would exist alike in areas of slow elevation, of rest, or of slow subsidence." He thinks that he has succeeded in proving that foundations have been prepared for these two classes of reefs by the disintegration of volcanic islands, and by the building up of submarine volcanoes by the deposition on their summits of organic and other sediments, maintaining that when "coral plantations build up from submarine banks they assume an atoll form, owing to the more abundant supply of food to their outer margins, and the re-

moval of the dead rock from the interior portions by currents, or by the action of carbonic acid dissolved in sea-water ;" further, that " barrier reefs have built out from the shore on a foundation of volcanic debris or on a talus of coral blocks, coral sediments, and pelagic shells, and the lagoon channel is formed in the same way as a lagoon."

7th March, 1882.

PUBLIC MEETING IN ST. GEORGE'S HALL.

The President, Robert Lloyd Patterson, Esq., in the Chair.

Mr. A. R. Wallace, Lectured on

ISLAND LIFE.

4th April 1882.

The President, Robert Lloyd Patterson, Esq., in the Chair.

Mr. R. Young, C.E., read

NOTES ON BUN-A-MAIRGE ABBEY AND ITS SURROUNDINGS.

The reader at the outset referred to the great interest which the north-eastern coast of the county Antrim possesses for the artist and the antiquary. The cliff scenery all the way from Larne to Portrush is probably unrivalled in respect of variety and colouring, and the mural precipices of columnar basalt, which attain their greatest height in Fair Head, near Ballycastle, add a character of peculiar solemnity to the landscape. Forming, as it did, a part of Dalriada, this portion of Antrim was in very early times brought into close relations with the western side of Scotland, and the little town which was founded at the mouth of the Mairge river, and was known subsequently as Markstown, seems to have been the chief port of communication on the Irish side. At a later time, the district of which Ballycastle may be considered the centre, became the battle-ground on which the rival clans of MacDonnels and M'Quillans engaged in deadly strife, which only ended in the complete defeat of the M'Quillans in the year 1559, on the slopes of Slieve-an-Aura, at the head of Glenshirsk.

There seems no reason to doubt that it was one of the chieftains of the M'Quillans who erected the little Franciscan monastery, of which we now see only some fragments in the picturesque remains on the banks of the Mairge river.

After giving a minute description of the Abbey Church and the monastic buildings now traceable, which was illustrated by several plans and sketches, the reader proceeded to discuss the question of the age of the foundation. He exhibited a careful drawing he had lately made of the exterior of the east gable of the church, and pointed out the evidence it contained in the remains imbedded in it of an earlier and larger window, and by a reference to drawings of similar portions of abbey churches in other parts of the North of Ireland, and specially that of Killydonnel, in county Donegal, of which the date is known, he concluded that the first building was certainly not later than 1450, and probably a good deal earlier, and that the alterations made by Roory M'Quillan about 1500, as recorded in a MS. in the British Museum, are the only and quite insufficient grounds on which to base his claims to be the original founder of the abbey.

In addition to the reader's own drawings, Mr. Lockwood lent a large plan of the abbey buildings, from actual measurements; and Dr. James Moore, R.H.A., exhibited a coloured sketch, taken a great many years ago, showing that a great deal of dilapidation had occurred since.

4th April, 1882.

The President, Robert Lloyd Patterson, Esq., in the Chair.

Mr. Isaac J. Murphy, read a Paper on

LINKAGES: A RECENT MECHANICAL INVENTION, BY MONSIEUR PEAUCELLIER.

About fifteen years ago Mons. Peaucellier, a lieutenant in the French army, living at Rennes, in Brittany, invented a simple machine by the use of which the power is obtained of producing perfectly straight lines, derived from acting on the motions of radii of circles. It appears that he remained for a considerable time, even some years, unaware of the magnitude of the importance, as of the novelty, of his invention—it may be said, of his discovery. About 1870, a student in the University of St. Petersburgh, named Lipkine, without communication with the prior inventor, made precisely the same discovery; and this at the very time when his preceptor, in all likelihood with his knowledge, was engaged in trying to prove that it is not possible to convert circular into correct lineal motion.

The machine of Peaucellier (fig. I.) is very simple; and the mathematical proof of its correctness is easy to master. It has since its first invention been subjected to various modifications, and with these modifications it has been found capable of producing circles of any radius, as well as many other curves, if not of producing any and all curves in the region of plane geometry. I wish to limit my present scope to the points I have already examined into. I therefore quote only, without following the unlimited road with all its branches which he

opens, Professor Sylvester's words:—"We are able, by this machine, to bring about any mathematical relations that may be desired between the distances of any two of the poles of the linkage (the name of the machine) from a third, and are thus potentially in possession of an universal calculating machine."

I proceed to speak of the practical and obvious use of Peaucellier's machine as applied in mechanics. The parallel motion of Watt, adopted for the purpose of giving as much directness as he was able to do to the pushing of a piston by the end or centre of a beam moving in the arc of a circle, is not perfect. As applied in the ordinary beam engine to the cross-head proper, it is so; but as applied to the air-pump piston, the supposed straight line through which its cross-head is directed is really a figure of 8. Accordingly, its frequently uneven (or wabbling) motion is apt to react on the head of the steam-cylinder piston, and to produce a tremulous vibration; which movement is sometimes incorrectly supposed to be due to a mechanical error in the parallel motion itself. The Peaucellier method has been applied with admirable success to cross-heads; in particular, the steam-engine which performs the work of the Houses of Parliament is so geared. There is, in fact, no common pump to which the plan is not applicable. It is evident that there must, in all cases, be a saving of power by substituting a direct for a crooked pushing motion.

Peaucellier has constructed linkages, or "cells," of two formations, each of seven bars; and a third linkage, based on the same mathematical principle as Peaucellier's, has been shown by a Cambridge man, consisting of only five bars—the smallest possible number capable of affording a true straight line. The original cell is (fig. I.) two equal bars (*a*), and four equal ones (*b*), connected by two equal ones (*c* and *d*), *d* being properly not a bar or rod, but the fixed distance equal to *c*. The two long bars move as the radii of a circle; the two bars (*b*) joined to *c*, move from the circumference of a circle whose radius is *c* or *d*; and the further end of the rhombus whose sides are *b*, moves, as *c* moves in its centre, so far as the limits of the machine permit, in a straight line perpendicular to

that diameter of the circle of which d is one-half. For (fig. II.) if ABC be a circle of which AB is a diameter, produced to E, and ED perdendicular to that diameter ; if AD be joined by a line ACD, the angle ACB being in a semicircle is a right angle ; and the angle BAC is common to the two triangles, ABC, ADE ; therefore

$AE : AD :: AC : AB$: and $AE \cdot AB = AD \cdot AC$;

so that the locus of D, when the above rectangle is a constant quantity, is in a straight line perpendicular to the diameter AC; and equally so whether D be within or without the circle. Bisect CD in G ; and draw any line GF perpendicular to CD ; and join DF and CF. Then the difference of the squares of AG and GD is equal to the difference of the squares of AF and FC (or FD): and is also equal to the rectangle under their sum AD and difference AC ; which has been shown to be constant. But AF and FD are equivalent to the a and b of Peaucellier's linkage ; which accordingly succeeds in drawing a mathematically correct line in DE. Peaucellier's other cell (fig. III.) differs from this in that the four equal bars (b) have the pair of bars (a) inside them ; when, to produce the straight line, the fixed bar or distance d must be linked to the pair a. If otherwise, and the bar c in either linkage were the fixed one, the traversing point D would describe a very curious curve ; the law of which I shall presently state.

Peaucellier calls the original cell—that with the smaller rhombus—his positive cell ; and that with the rhombus outside the pair of bars, negative. It was some time before I recognized the appositeness of these terms ; preferring the more obvious ones of "external" and "internal." But I am convinced, by the consideration of the geometrical proposition on which the proof is based, that Peaucellier's names are the most logical. The proposition, stated to cover all the cases, is :—If straight lines be drawn from any point to the extremities of any diameter of a circle in the same plane as the point, the rectangle under each of such lines and its segment (or segment produced) intercepted in the circle is equal to the rectangle under the diameter of the circle and its segment towards that extremity met by each

straight line respectively, formed by the falling of a perpendicular upon such diameter (or diameter produced) from the given point;—and;—the sum of such rectangles is equal to the square of the diameter if the perpendicular falls within the circle, and their difference if it falls without it ; or their sum in both cases if one of the segments has its place in the semicircle furthest from the point, and is therefore regarded as *minus*. Now the demonstration of Peaucillier's first, or positive cell, depends on that case of this proposition in which the perpendicular from the given (or as I have shown, traversing) point on the diameter does not pass it, and its segment within the circle is part of itself, or positive ; while the demonstration of the negative cell depends on the other case. In investigating the curve produced by fixing the bar c, and moving d, as also in the case of other curves produced by the machine, I met with confirmation of this view.

If c and d are made unequal, D will describe an arc of a circle the centre of which is in d or d produced ; its radius depending on the magnitudes of the various bars of the linkage, and on the distance d, viz.:—

$$\frac{c(a^2 - b^2)^*}{c^2 - d^2}$$

Accordingly, when a is greater than b, and c greater than d, the concavity of the arc is towards the figure (positive cell); the centre of the circle lying in d produced in the direction of A (fig. VI.) and in the same cell, if c is less than d, the concavity of the arc is from the figure. In the negative cell, c must be less than d to draw an arc with its convexity towards the figure ; and the minus sign appears when the centre of the circle lies in the part of d produced which is away from A. I believe this is the first time in the history of mathematics that a circle has

* Assuming that the path of the point D in fig. VI. is an arc of a circle, and taking any distance e, the dotted line between C and A as a variable, we can obtain expressions for the sine and versed sine of the arc in terms of a, b, c, d, and e ; then, as

$$\frac{\sin^2 + \text{versin}^2}{2\text{versin}} = \text{rad.}$$

in the simplest form of which fraction the variable e disappears, the assumption must be true.

been described from a centre (if we may so speak) not within itself. This property of Peaucellier's invention has been put to practical use.

The curve which D describes when c is fixed and d is moved is a curious one (fig. IV.) ad infinitum in each direction, always approaching but never reaching a straight line at right angles to the axis of the curve, the axis being $2C$. The figure is under the curve. In the negative cell its inclination is reversed. The conjugate is

$$\frac{a^2 - b^2}{2c}.$$

If, in the positive cell, the transverse and conjugate be made equal, the two arms of the curve will meet in a cusp; and if the conjugate be the less, they will form a loop. I have been unable to find an expression for the ordinate without using a variable. The law of the curve is :—

Abscissa : axis : : ordinate^2 : ordinate^2 + (abscissa + conjugate − transverse axis)^2.*

It remains to describe the five-linked cell. If two pairs of bars ($a\ a$ and $b\ b$) cross one another as in fig. V., at whatever angle they may be, the product of the distances AB and CD is

*The ordinate, using e as a variable, is

$$\frac{\sqrt{(2c)^2 - e^2}(a^2 - b^2 - e^2)}{2ce};$$

the abscissa

$$\frac{(2c1^2 - e^2)}{2c}$$

squaring the ordinate and dividing, we obtain

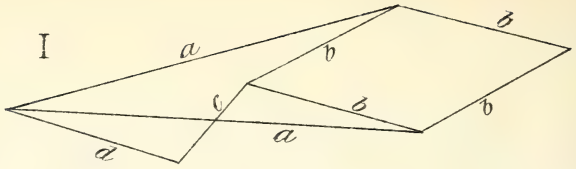
$$\frac{(a^2 - b^2 - e^2)^2}{2ce^2} = \frac{\text{ord}^2}{\text{abs}},$$

which is equal to

$$\frac{\text{diag of rhomb}^2}{\text{axis}}.$$

But an examination of the figure (VII.) will show that the diagonal of the rhombus is equal to the square root of the square of the ordinate + the square of the abscissa + conjugate — transverse. If the conjugate be less than the axis of the curve—that is if D be nearer to A than C is, this last quantity may become minus; but this does not affect the law of the curve, as it must be squared.

constant, being $=AD^2-AC^2$. Taking any four points in a straight line parallel to the dotted lines AB and CD, viz., EFG and H, EF has a constant ratio to AB, and EG has a constant ratio to CD; wherefore EF, EG is constant; also EF, FH is constant. Thus by fixing equal links to E and F, according to the proof in the proposition, the link attached to E being stationary and that attached to F moving from the centre K, G will always traverse in a straight line perpendicular to EK, or, the link attached to F being made stationary, H will traverse, as in the negative cell, in a line perpendicular to FK.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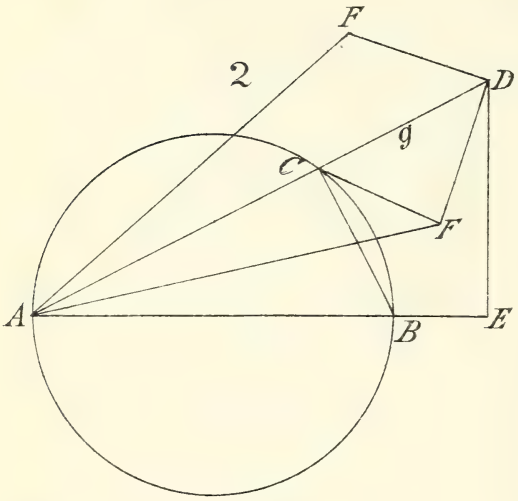
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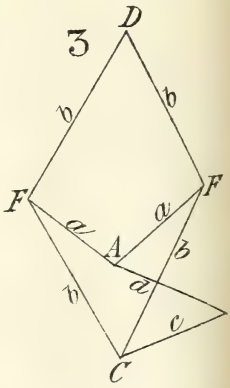
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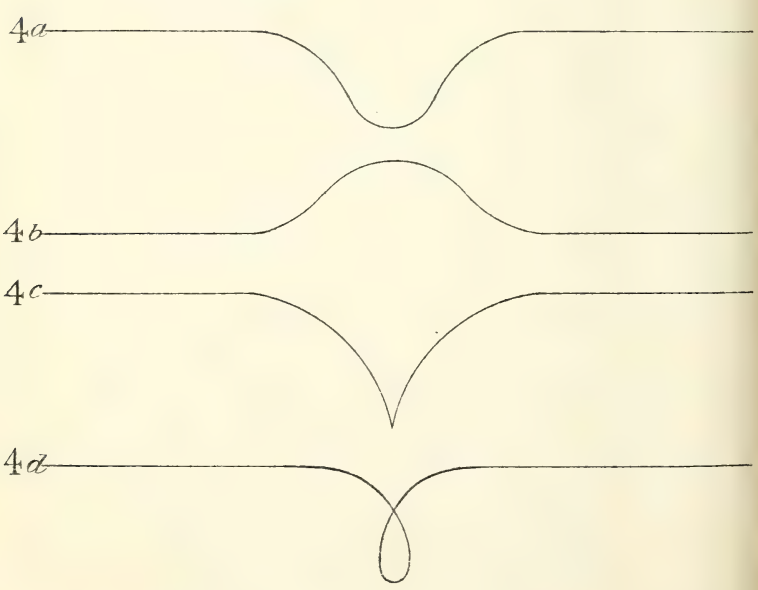
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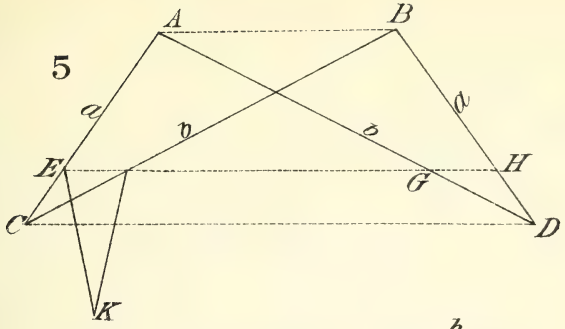

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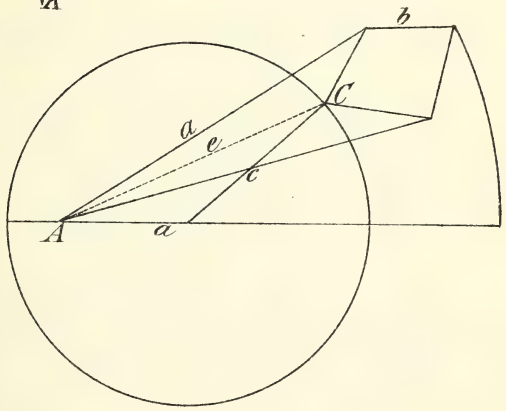

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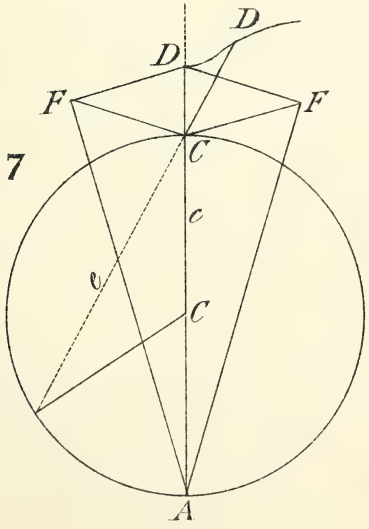

25th April, 1882.

The President, Robert Lloyd Patterson, Esq., in the Chair.

A Paper was read by Rev. Robert Workman, on

FORTS, HOUSES, AND CHURCHES OF ANCIENT IRELAND.

Mr. Workman began by directing attention to the raths, duns, and caishels as being from their number and antiquity among the most important monuments of our country. These forts consisted of an earthen or loose stone dyke, enclosing a circular space. The dyke originally had a height of from eight to twelve feet. Beehive-shaped huts have been found in several of these encampments, and there is often an underground passage or chamber beneath them. These were doubtless the fenced camps of the Irish tribes; the chief and his immediate followers harboured within them, and in time of war they sheltered the clan and the cattle against a sudden attack. Earth forts were the strong places of the Irish from the most remote antiquity till the end of the thirteenth century, but when the English appeared upon the scene they lost their importance, as being unsuitable to the new modes of warfare then introduced.

Mr. Workman then referred to ancient houses as throwing light upon the condition of the country, since a few Irish houses with their furniture would enable us to know what were the habits and the civilisation of the people. Here, however, was the difficulty, for Irish houses were of such frail materials that they have perished. Mr. Workman held that the body of the common people in the interior of the country had scarcely any-

thing worthy of the name of houses towards the close of the sixteenth century. The English penetrating to the centre of Ulster, in 1542 found it a jungle. Tyrone's country is described as "not containing a single castell, nor yet one walled town; nothing but bogs of water, so that it would be hard to have it inhabited." Sir Fulke Conway, one of the principal settlers in King James's Plantation of Ulster wrote home saying: "This part of ye country is bleak and desolate as though foot of man had never penetrated the wilderness." The English Government described Derry as we would now describe the most remote and unappropriated colonial fields; and English captains, finding no spoil of war, complained that "the Irish in the interior lived without houses, and that O'Neill kept his people and cattle in such wild places that the English could not reach them, nor even certainly know their whereabouts." Traps to catch wolves were part of the provision made for Ireland by Cromwell's Government; and in the year 1683 a considerable quantity of fox and other skins was exported from Belfast to England, Holland, and the Baltic.

Mr. Workman showed that Irish houses were built of wood, wattles, and mud, and in some cases of loose stones, till long after the English invasion. Tara Hill, which was the abode of kings and chieftains, and a place where the most substantial buildings might be expected, had nothing but houses of wood and clay, and there is no evidence that mortar was ever used in pagan times. Irish houses were beehive-shaped, probably because wattles and clay were most readily fashioned into a house of such a form.

Mr. Workman here exhibited a *fac-simile* of a map of Carrickfergus in Elizabeth's time, in which, side by side with the castelled houses of the English, the primeval cabins of the Irishry were depicted. These huts were half globes, without eaves or chimney, a single aperture serving for door and window. The reader also showed a sketch of a stone house of similar form from Arran, in Galway Bay, which is believed to date from pagan times, and gave it as his opinion that these were the dwellings of a people who lived in the open air, and were stran-

gers to sedentary pursuits. Cattle-tending and hunting were their constant occupations. Forays and skirmishes with neighbouring clans were the scenes in which the men delighted to display their strength and skill.

In referring to the architecture of early Christian times, Mr. Workman said that the monastery characterised the Irish Christianity of the sixth century. The primitive Irish monasteries were very practical institutions. Having no missionary societies to aid them, the brethren supported themselves cultivating the soil, rearing cattle and fowl, and fishing the loughs and seas. Their spiritual work was the instruction of Christian converts and the training of young evangelists. Division of labour developed the gifts of individuals: the ready writer copied manuscripts, the artist illuminated them, and the man skilled in metals wrought the croziers and relic shrines which display such care and taste.

There is ground for considering that these monastic institutions were peculiarly adapted to the state of the country. Ireland was peopled by a number of independent tribes continually at war. Plunder and slaughter were the serious business of the chieftains and the work they demanded of their followers. How were Christian converts to live in societies where they must follow these practices? And how, on the other hand, could they exist outside the protection which the clan afforded to its members? Both missionaries and converts required the protection and encouragement which the monastic community afforded. The monks adapted themselves to the customs of the people, and adopted the rath as a defensive enclosure of the space on which they erected their chapel and cells; and the sole distinction of the monastic rath is the presence of a chapel of rectangular form, in a few instances cemented with mortar. The monks dwelt in globular cells, armed similarly to those already described. Thus the ecclesiastical establishment was a half military camp down to the twelfth century, for the Irish Church was truly a Church militant, and her chapels and houses had need of all the protection the rath could afford. As to materials, Mr. Workman showed that Irish ecclesiastical

buildings were commonly recognised as of a peculiar construction, which had come to be designated as the Scotic manner; that one peculiarity of the Scotic method consisted in the materials employed, which were not stone and mortar, but wood and earth; and that a quadrangular building was a great novelty in early times. Mr. Workman held the small solid-roofed church to be the earliest type of ecclesiastical building. Its average size was sixteen feet by ten feet; it was destitute of ornament, and of a stern simplicity. It had one door and one window, and in it the distinction between nave and chancel is still unknown. There is an extreme rudeness of form, for many of these churches are built of dry stone, without cement of any kind.

Mr. Workman undertook to show the gradual transition from the round cell of pagan times to this primitive chapel, and exhibited drawings of chapels in which the corners had been rounded off so as to make the ground plan approach the circular form, and the walls had been made to converge from the very ground till they met in an arching roof. He held that in such instances we actually find the pagan cell passing over and being transformed into the rectangular perpendicular-walled chapel. We have thus pushed back our inquiry till we touch pagan times, and cannot doubt that we have in these single chambered churches the primitive type of Irish Christian sanctuary.

In regard to the round towers, Mr. Workman held it had been established that they were belfries and places of refuge, and believed they were erected about the tenth and eleventh centuries. Endeavouring to show how the idea of the round tower had originated, he pointed out that the peculiar features which distinguished it, its circular form and solid pointed roof, lay ready to hand, and were familiar in the monastic rath. The beehive cell suggested the round form, and the solid pointed roof of the primitive chapel only required to be raised in the air and placed upon the summit of the lengthened column. When the ravages of the Danes made them feel the need of a temporary defence, it was the most natural thing in the world that, taking the circular foundation of a cell as the ground plan,

they should build upon it high enough into the air to form a comparatively safe refuge and storehouse against their assailants. The round tower is, therefore, to be regarded as a genuine original Irish development from architectural forms already present.

Mr. Workman considered that the civilization of Ireland was almost entirely an ecclesiastical civilization. The Church and the world were in contact, but they did not blend. During the period when Ireland was looked on as an island of saints and scholars, and Irish monks were evangelising the barbarous hordes abroad, there does not appear to have been any corresponding manifestation of culture amongst Irish laics. Irish secular life has left no trace behind, and almost all remains, architectural or artistic, are ecclesiastical remains. Irish Church antiquities, however, do possess an interest all their own—the primitive stone-roofed churches, as substantial as if they had been hewn out of the rock ; the isolated pillar tower, which in other days sheltered the monks from the furious Northmen, and which now stands grey and solitary and mysterious, the most prominent object upon the plain ; the crosses, which commemorate the early founders of Christianity. These interesting memorials are only to be found in our country and in those parts of Scotland which came under the influence of Irish Christianity.

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Bristow, James R., Northern Bank, do.
Barbour, James, Falls Foundry, do.
Boyd, William, Blackstaff Mill, do.
Boyd, W. S., Donegall Quay, do.
Brown, John Shaw, J.P., Bedford Street, do.
Brown, John, Bedford Street, do.
Burden, Henry, M.D., Alfred Street, do.
Burnett, John R., Gamble Street, do.

*Campbell, James (Representatives of).
Campbell, John, Lennoxvale. Belfast.
Connor, Charles C., White Linen Hall, do.
Carlisle, James, J.P., Donegall Street, do.
Carson, John, Church Lane, do.
Charley, John (Representatives of), do.
*Charley John (Representatives of), Finaghy, do.
*Clermont, Lord, Ravensdale, Park, Newry.
Coates, Victor, Rathmore, Dunmurry.
*Charters, John (Representatives of).
Crawford, William, Calender Street, Belfast.
Cuming, James, M.D., Wellington Place, do.
Combe, James, J.P. (Representatives of).
Connor, James (Reps. of), Great George's Street, Belfast.
Calwell, Alexander, McD., College Square North, do.
Cunningham, Robert O., M.D., F.L.S., Queen's College, do.
Clarke, Edward H., Elmwood, do.

Darbishire, James M., Lombard Street, do.
*Donegall, Marquis of, K.P., &c., &c., London.

Drennan, Dr., Chichester Street, Belfast.
*Drummond, Dr. James L. (Representatives of), do.
Duffin, Charles, J.P., Waring Street, do.
Dunville, William, J.P. (Representatives of), Calender St., do.
*Downshire, Marquis of, Hillsborough Castle, Hillsborough.
Dixon, Thomas S., York Street, Belfast.
Emerson, William, Donegall Quay, do.
Everett, J. D., M.A., D.C.L., F.R.S., Queen's College, do.
Ewart, William, J.P., M.P., Bedford Street, do.
Ewart, W. Quartus, Bedford Street, do.

*Fenton, Samuel G., J.P. (Representatives of), do.
Ferguson, Henry, M.D., Fisherwick Place, do.
Forsythe, R. H., Holywood.
Finlay, William Laird, Windsor, Belfast.
Finlay, William Laird, jun., 16, Corporation Street do.
Fuller, Professor George, Queen's College, do.
Fagan, John, F.R.C.S.I., Glengall Place, do.

Garrett, Thomas, Gamble Street, do.
*Getty, Edmund (Representatives of), do.
Girdwood, H. Mercer, Broughton Maxwell, Manchester.
Gordon, Alexander, M.D., Howard Street, Belfast.
Gordon, R. F., J.P., D.L., Florida Manor, Killinchy.
*Grainger, Rev. John, D.D., Broughshane, Ballymena.
Gray, Robt. (Representatives of), College Square North, Belfast.
Gordon, Robert W., Falls Road, do.
Greer, Thomas, J.P., M.P., Seapark, Carrickfergus.
Gray, William, C.E., M.R.I.A., Mount Charles, Belfast.

Hogg, John, Academy Street, do.
*Hamilton, Hill, J.P. (Representatives of), Mount Vernon, do.
Hancock, John, J.P., Lurgan.
Henderson, Robert (Representatives of), High Street, Belfast.
*Henry, Alexander, Manchester.
*Herdman, John (Representatives of), College Sq. North, Belfast.

Hind, James, Durham Street, Belfast.
Hind, John, J.P., Durham Street, do.
Hind, John, jun., College Street South, do.
Heyn, James, A.M., Ulster Chambers, Waring Street, do.
*Houston, John B., J.P., D.L., Orangefield, do.
Herdman, John, J.P., Carricklee House, Strabane.
Hamilton, Sir James, J.P. (Reps. of), Corporation St. Belfast.
Harland, Edward J., J.P., Queen's Island, do.
Hodges, John F., M.D., F.C.S., Queen's College, do.
Hyndman, Hugh, LL.B., Waring Street, do.
Henderson, W. D. (Representatives of), Victoria Street, do.
Henderson, James Alexander, J.P., Donegall Street, do.
Holford, T. & A., Dorsetshire (Cern Abbas).

Jackson, Thomas, C.E., Corn Market, Belfast.
Jackson, W. R., Corn Market, do.
Jaffé, John, Donegall Square South, do.
Jaffé, Otto, Donegall Square South, do.
*Johnson, Sir William G., J.P., D.L., College Sq. North, do.
Johnston, Samuel A., Jennymount Mill, do.
Johnston, David W., Jennymount Mill, do.

Kennedy, James, Falls Road, do.
Keegan, John J., High Street, do.
*Kinghan, Rev. John, Deaf and Dumb Institution, do.

Lanyon, Sir Charles, J.P., The Abbey, Whiteabbey.
Lepper, F. R., Ulster Bank, Belfast.
Lakin, Mrs. John, Tamworth.
Lamb, William W., Divis View, Belfast
Letts, Professor E. A., Queen's College, do.
Lytle, David B., Victoria Street, do.

*Macrory, Adam J. (Representatives of), Ulster Chambers, do.
Mitchell, W. C., J.P., Tomb Street, do.
*Mitchell, George T. (Representatives of), do.

Montgomery, Thomas, J.P., Ballydrain, Belfast.
Moore, James, J.P., Dalchoolin, Craigavad.
*Mulholland, Andrew, J.P., D.L. (Representatives of), Belfast.
Mulholland, J., J.P., D.L., M.P., Ballywalter Park, Ballywalter.
Mullan, William, J.P., Victoria Street, Belfast.
Murney, Henry, J.P., M.D., Donegall Square East, do.
Musgrave, James, J.P., Ann Street, do.
Murray, Robert (Representatives of), Arthur Street, do.
*Murphy, Joseph John, F.G.S., Old Forge, Dunmurry.
*Murphy, Isaac James, Glenburn, do.
Musgrave, Henry, Ann Street, Belfast.
Musgrave, Edgar, Ann Street, do.
Moore, James, Donegall Place, do.
*M'Calmont, Robert, London.
*M'Cammon, Thomas, Dublin.
M'Clure, Sir Thomas, Bart., V.L., M.P., J.P. Belmont, Belfast.
M'Cance, Finlay, J.P., Suffolk, Dunmurry.
*M'Cance, J. W. S. (Representatives of), Suffolk, Dunmurry.
*M'Cracken, Francis (Representatives of), Donegall St., Belfast.
MacAdam, Robert, College Square East, do.
MacIlwaine, Mrs. Jane, do.
MacIlwaine, Rev. Canon, D.D., M.R.I.A., Netherville Terrace, Belfast.
*MacLaine, Alex., Queen's Elms, Belfast.
M'Gee, John G., High Street, do.

Neill, John R., Queen's Arcade, do.

Patterson, E. Forbes, High Street, do.
Patterson, Mrs. M. E., Ardmore Terrace, Holywood, do.
Pim, Edward W., High Street, do.
Pim, George C., Corporation Street, (Representatives of), do.
*Pirrie, John M., M.D. (Representatives of), do.
Purdon, Charles D., M.D. (Reps. of), Wellington Place, do.
Purdon, Thomas Henry, M.D., do. do.
Patterson, William R., Lower Crescent, do.

Patterson, R. Lloyd, J.P., Corporation Street, Belfast.
Patterson, William H., M.R.I.A., High Street, do.
Purser, Professor John, M.A., Queen's College, do.
Porter, Rev. J. Scott (Representatives of), do.
Patterson, Richard, High Street, do.
Patterson, David C., Corporation Street, do.

Riddell, William, Ann Street, do.
Rowan, John, York Street, do.
Ritchie, W. B., M.D., J.P., The Grove, do.
Ross, William A., J.P., Clonard, Falls Road, do.
Rea, John Henry, M.D., Great Victoria Street, do
Robertson, William, J.P., Bank Buildings, do.
Robinson, John, York Street, do.

Simms, William (Reps. of), White Linen Hall, do.
Sinclair, Thomas, M.A., J.P., Tomb Street, do.
Suffern, John, Windsor, do.
Suffern, William, Windsor, do.
Steen, Dr. Robert, Ph.D., Academical Institution, do.
Smyth, John, jun., M.A., C.E., Milltown, Banbridge.
Smith, F. Chaloner, Sandymount.
Swanston, William, F.G.S., King Street, Belfast.

*Tennent, R. J., J.P., D.L. (Representatives of), Rushpark, do.
*Tennent, Robert (Representatives of), Rushpark, do.
Thompson, Robert, J.P., Fortwilliam Park, do.
Thomson, Charles, College Gardens, do.
*Thompson, James, J.P., Macedon, Whiteabbey.
*Thompson, Nathaniel (Representatives of).
*Thompson, William (Representatives of), Belfast.
*Turnley, John (Representatives of), do.
Torrens, James, J.P., Wellington Place, do.

Valentine, James W., Custom House Square, do.
Valentine, Thomas, J.P., The Moat, Strandtown, do.

Walkington, Thomas R., Waring Street,	Belfast.
Workman, William, Corporation Street,	do.
Workman, Rev. R., Newtownbreda.	
Wilson, John K., Donegall Street,	do.
*Wilson, Robert M.	
*Workman, Thomas, Bedford Street,	Belfast.
Wallace, James, Ulster Bank,	do.
Ward, Fras. D., J.P., Bankmore,	do.
Wright, Joseph, F.G.S., Donegall Street,	do.
Workman, Charles, M.D., Balmoral Terrace,	do.
Workman, Rev. R., Glastry, Kirkcubbin.	
Walkington, D. B., Windsor,	do.
Young, Robert, C.E., Donegall Square East,	do.
Young, Robert M., Donegall Square East,	do.

HONORARY MEMBERS.

Robinson, Hugh, Donegall Street,	Belfast.
Stewart, Samuel A., F.L.S., North Street,	do.
Tate, Professor Ralph, F.G.S., Adelaide, South Australia.	

ANNUAL GUINEA SUBSCRIBERS.

Barber, J., County Down Railway,	Belfast.
Bruce, James, J.P., Calender Street,	do.
Bulloch, A., Donegall Square South,	do.
Corry, James P., J.P., M.P., Dunraven, Windsor,	do.
Craig, James, J.P., Calender Street,	do.
Corry, Thomas H., Benvue, Malone,	do.
Collier, W. F., LL.D., Belfast Academy,	do.
Carr, James, Ulster Bank,	do.
Dinnen, John, Chichester Street,	do.
Dunville, Robert G., D.L., J.P., Calender Street,	do.
Finlay, Alexander, Ann Street,	do.
Glass, James, Bedford Street,	do.

Glover, G. T., Ballymacarrett,	Belfast.
Graham, O. B., J.P., York Street,	do.
Liversedge, H. J., Lagan Foundry,	do.
Loewenthal, J., Linenhall Street,	do.
Lynn, William H., C.E., Calender Street,	do.
Matier, Henry, J.P., Clarence Place,	do.
Mulholland, J. R. T., J.P.,	do.
M'Auliffe, George, J.P., Calender Street,	do.
Oakman, Nicholas, Prospect Terrace,	do.
Pring, Richard W., Corn Market,	do.
Redfern, Peter, M.D., Professor Queen's College,	do.
Reade, Robert H., York Street,	do.
Seeds, William, Corn Market,	do.
Taylor, David, J.P., Windsor,	do.
Tate, Alexander, C.E., Queen's Elms,	do.
Taylor, John Arnott, M.A., Bridge Street,	do.
Watt, R., Donegall Place,	do.
Wolff, G. W., Queen's Island,	do.
Wilson, James, Skipper Street,	do.
Ward, John, F.G.S., Lennoxvale,	do.
Ward, Marcus J., Bankmore,	do.

The Belfast Natural History and Philosophical Society, for the Year ending 1st May, 1882, in Account with Treasurer.

Dr. **Cr.**

EXPENDITURE.

1881. Aug.	—To Cash paid Insurances	£11	5 0
Nov.	,, ,, through Librarian ..	2	0 8
,,	,, ,, Rent till 1st Feb., 1882	25	0 0
,,	,, ,, A. Mayne, Printing ..	23	13 0
,,	,, ,, A. O'D. Taylor ..	6	13 2
,,	,, ,, S. A. Stewart, Salary till 1st April ..	43	15 0
,,	,, ,, W. Darragh, Salary till 1st May, ...	48	0 0
1882. Feb.	,, ,, Wm. M'Cammond, Contractor, Drains, &c.,	21	15 10
May	,, ,, Robert Murray & Co., Platform, &c. ..	5	5 0
,,	,, ,, Coals, Coke, and Gas, ..	14	4 4
,,	,, ,, Easter Expenses £7 7s 5d, Collecting Subscriptions £6 17s 6d	14	4 11
,,	,, ,, Sundry Accounts, including Postages £1 9s 10d, Advertising £7 10s 8d, &c.	14	5 1
,,	To Balance in Treasurer's hands ..	0	15 6
		£230	17 6

RECEIPTS.

1881. May 1	—By Balance in hands	£38	3 10
,,	,, Subscriptions in Arrear, and Transfer Fees	3	15 6
Nov.	,, Interest on York Street Loan ..	18	12 1
1882. Jan.	,, New Shares taken up, 1880 ..	21	0 6
May	,, Subscriptions in Arrear, and Donation through Librarian	3	5 0
,,	,, Naturalists' Field Club Contribution	5	5 0
,,	,, Subscriptions for year ending Nov., 1881	91	15 0
,,	,, Entrance Fees at Door, till 1st May	17	17 6
,,	,, ,, ,, Easter Monday	31	3 1
		£230	17 6
1882. May 1	—By Balance	0	15 6

Examined and found correct, *June 3rd*, 1882.

WM. H. PATTERSON, SAMUEL ANDREWS, } *Auditors.*

JOHN ANDERSON, *Hon. Treasurer.*